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FOREST SURVEY RELEASE NO. 15 DECEMBER 15, 1943

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THE FOREST SITUATION IN THE MOUNTAIN REGION OF VIRGINIA

by

Thomas Lotti
Forest Economist
and
Thomas C. Evans
Associate Silviculturist

A FOREST SURVEY PROGRESS REPORT

J. W. Cruikshank, Regional Survey Director

U. S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE

Appalachian Forest Experiment Station
R. E. McArdle, Director
Asheville, N. C.

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PREFACE

Through the McSweeny-McNary Act of May 1928, Congress authorized the Secretary of Agriculture to conduct a comprehensive survey of the forest resources of the United States. The Forest Survey was organized by the Forest Service to carry out the provisions of the Act, and each of the 11 Regional Experiment Stations is responsible for the work in its territory. In the Middle Atlantic States the Forest Survey is an activity of the Appalachian Forest Experiment Station, Asheville, North Carolina.

The work of the Survey is divided into five major phases:

1. Inventory. Determination of the extent, location, and condition of forest lands, and the quantity, species, and quality of the timber on these lands.

2. Growth. Determination of the current rate of timber growth.

3. Drain. Determination of the amount of industrial and domestic wood use, and the total loss from fire, insects, disease, suppression, and other causes.

4. Requirements. Determination of the current and probable future requirements for forest products, by all classes of consumers.

5. Policies and plans. Analysis of the relation of these findings to one another and to other economic factors as a basis for public and private policies and plans of forest land use and management.

This progress report presents preliminary information on the first three of these phases for the Mountain Region of Virginia which includes 2 (Units 4 and 5) of the 5 survey units into which the State was divided. Similar releases have been prepared for the Piedmont Region (Units 2 and 3) and for the Coastal Plain (Unit 1).

Information on the physical forest resources was obtained by a field survey made in the fall of 1940. A total of 11,070 sample plots was established at intervals of one-eighth of a mile on compass lines 10 miles apart, extending across the Mountain Region in a northwest direction. The statistical sample obtained from these plot records forms the basis for all area and volume estimates in this report, except where other sources are directly credited. Owing to the method of sampling, small tabular items have the greater probability of error and should be considered as indicating relative magnitude rather than actual values.

Data on consumption of forest products for industrial and domestic purposes were obtained by a canvass of all primary manufacturing plants and a number of representative domestic consumers, made in the first half of 1941.

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SIGNIFICANT FACTS

Forest land occupies 5.0 million acres, 55 percent of the region's area. About 0.2 million acres of forest is not capable of producing sawlog size trees. Cutting is prohibited on 0.1 million acres, practically all in national park. However, most of the forest land, 4.7 million acres, has the qualities essential to commercial timber production.

The past management of the forest is well reflected by its present status. There remains only 0.1 million acres of old growth. Saw timber volume aggregates 5.7 billion board feet, slightly over 1,000 board feet per acre. Total volume is 54.6 million cords, but 12 percent is dead chestnut and 25 percent is in cull trees. Hardwoods, as a group, form over four-fifths of the stand, yet over one-half of their volume consists of low value species such as chestnut, black, pin, scarlet, and post oaks, red maple, black gum, and scrub hardwoods. Small trees predominate as about two-thirds of the softwood and over one-half of the hardwood growing stock is in trees under 13 inches in diameter.

In spite of the depleted condition of the forest there are about 1,000 sawmills, principally of the portable type, operating in the region. Furthermore, there are 33 other primary forest products plants including 3 pulp mills. The sawmills produced 197.5 million board feet of lumber in 1940. But, in that year, more wood was used for fuelwood than for any other single purpose, over 1.0 million cords of wood being consumed.

In 1940, total amount of wood cut from the sound tree growing stock was 211.5 million board feet or 923.7 thousand cords. Current annual growth was 1,376.9 thousand cords, resulting in an increase of 453.2 thousand cords in the growing stock. However, the softwoods 14 inches d.b.h. and larger were overcut by 15,300 cords as were the 20 inch and larger hardwoods by 6,900 cords. Also, much of the increase in growing stock included that on inferior species and on trees which for various reasons may never be cut. Thus, the net gain was probably less than the figures indicate.

If drain was maintained at the 1940 level for 30 years it might be possible to double the volume of the total growing stock. Even so, the stand would average only a shade over 2,000 board feet per acre and contain as great, if not a larger, proportion of inferior species than existed in 1940. Actually the results would be more favorable if a lighter drain and more intensive forest practices than those prevailing in 1940 were in effect.

War needs have brought about an increase in drain much of which is concentrated on the large, high quality growing stock. The net result of war drain will be an increase in the proportion of inferior species and cull trees, thereby aggravating the existing complex problems of utilization and management.

Measures designed to correct a forest situation such as exists in this region include: improved protection from fire, insects, and disease; expansion of forestry extension programs; development of farm-forest cooperatives; intensified forest research; extension of state forest ownership; and public control of cutting practices on private land.

STATISTICAL SUMMARY

Item	Entire State	Mtn. Region of Va.	
Area	Acres	Acres	Percent
Total	25,535,400	9,106,000	36
Non-forest land	10,703,100	4,149,700	39
Forest land	14,832,300	4,956,300	33
Public reserved	235,900	107,000	45
Non-commercial	184,400	184,400	100
Commercial	14,412,000	4,664,900	32
Softwood types	6,168,800	1,014,000	16
Shortleaf pine	1,909,500	528,800	28
Virginia pine	2,007,400	285,100	14
White pine-hemlock	236,100	200,100	85
Loblolly pine	2,015,800	0	0
Hardwood types	8,243,200	3,650,900	44
Mountain	6,717,100	3,216,200	48
Cove	1,526,100	434,700	28
Saw timber	7,154,800	1,967,000	27
Softwood	3,223,700	445,000	14
Hardwood	3,931,100	1,522,000	39
Cordwood	6,553,300	2,569,000	39
Softwood	2,560,300	558,800	22
Hardwood	3,993,000	2,010,200	50
Reproduction & clearcut	703,900	128,900	18
Softwood	446,400	55,300	12
Hardwood	257,500	73,600	29
Net Volume	M bd.ft.	M bd.ft.	
Saw timber	24,334,200	4,975,800	20
Softwoods	12,288,000	1,219,900	10
Hardwoods	12,046,200	3,755,900	31
	M cords	M cords	
Cordwood	204,511	54,607	27
Softwoods	63,583	6,433	10
Hardwoods	131,315	41,460	32
Chestnut	9,613	6,714	70
	Mil.cu.ft.	Mil.cu.ft.	
Cubic	12,643	3,055	24
Softwoods	4,431	477	11
Hardwoods	8,212	2,578	31
Volume Per Acre	Bd.ft.	Bd.ft.	
Saw timber	1,690	1,070	63
	Cords	Cords	
Cordwood	10.2	6.29	62

Item	Entire State	Mtn. Region of Va.	
Net Increment	M bd.ft.	M bd.ft.	Percent
Saw timber	1,611,300	238,200	15
Softwoods	863,700	57,900	7
Hardwoods	747,600	180,300	24
	M cords	M cords	
Cordwood	7,868	1,377	17
Softwoods	3,624	272	8
Hardwoods	4,244	1,105	26
	M cu.ft.	M cu.ft.	
Cubic	527,190	90,120	17
Softwoods	257,750	20,360	8
Hardwoods	269,440	69,760	26
Commodity Drain	M bd.ft.	M bd.ft.	
Saw timber	1,285,900	211,500	16
Softwoods	873,500	50,500	6
Hardwoods	412,400	161,000	39
	M cords	M cords	
Cordwood	5,131	924	18
Softwoods	3,110	194	6
Hardwoods	2,021	730	36
	M cu.ft.	M cu.ft.	
Cubic	350,100	61,280	18
Softwoods	220,300	14,550	7
Hardwoods	129,800	46,730	36
Industry	No.	No.	
Sawmills	2,763	999	36
Daily cap. 1-9 M	2,674	982	37
Daily cap. 10-19 M	71	11	15
Daily cap. 20 M plus	18	6	33
Non-lumber plants	156	33	21
Cooperage	69	4	6
Veneer	15	5	33
Handles	13	5	38
Pulp and paper	9	3	33
Tanning extract	9	9	100
Wood turning	5	1	20
Insulator pins	5	3	60
Shingles	3	1	33
Boxes	2	1	50
Mine wedges	1	1	100
Miscellaneous	25	-	-

THE FOREST SITUATION IN THE MOUNTAIN REGION OF VIRGINIA

PHYSICAL CHARACTERISTICS OF THE REGION

The mountain region of Virginia, Forest Survey Units 4 and 5, embraces 31 counties lying west of the Piedmont Plateau (fig. 1). Unit 4, the northern part, contains about 4,305,000 acres of gross area; and Unit 5, the southern part, contains 4,801,000 acres. The total area of the region approximates 9,106,000 acres or 14,228 square miles.

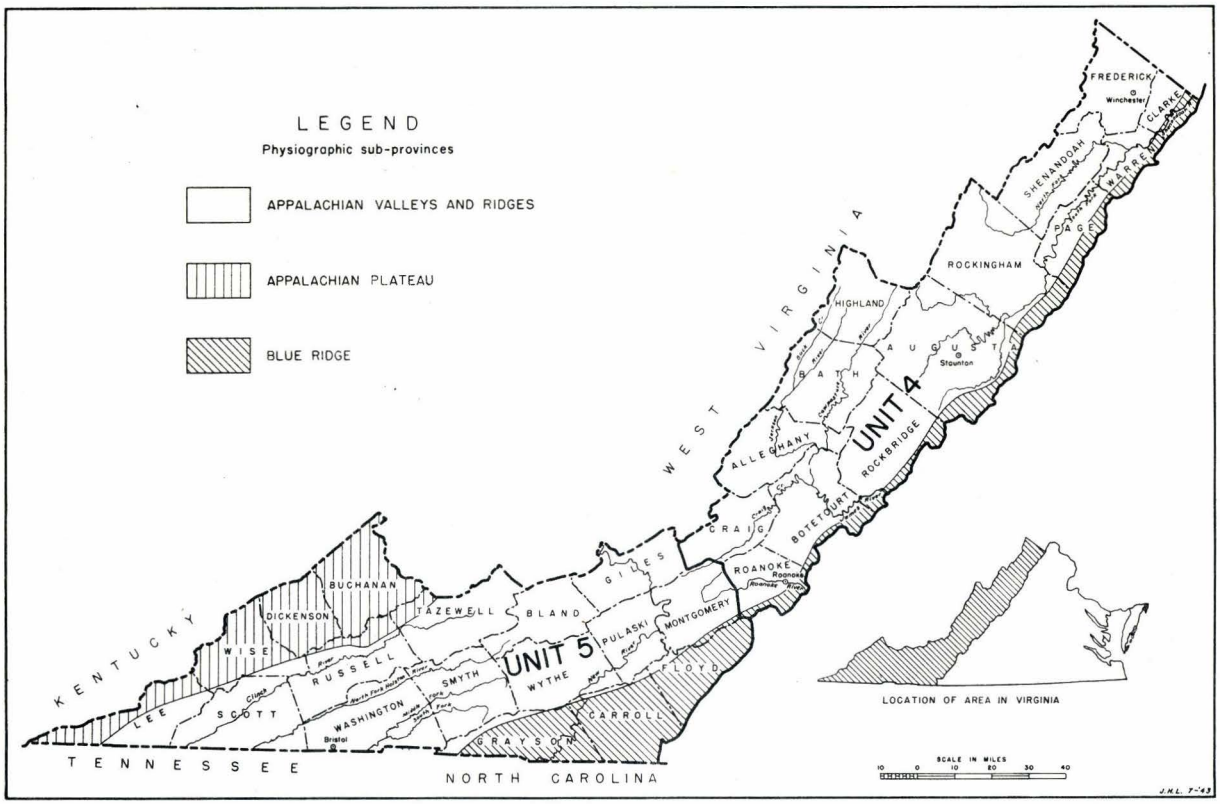

Figure 1. - The Mountain Region of Virginia, Forest Survey Units 4 and 5.

Physiographically, the mountain region of Virginia is part of the Appalachian Mountain province. Differences in geologic history and structure, and subsequent modification of the surface through weathering and erosion, have produced distinct characteristics in arrangement and form in various parts of the area. On the basis of these distinctions three well defined physiographic sub-provinces are recognized--the Blue Ridge, 2,100 square miles; the Appalachian Valleys and Ridges, 10,728 square miles; and the Appalachian Plateau, 1,400 square miles (fig. 1).

The headwaters of many important rivers or their tributaries are formed within the Virginia mountain region. The Potomac, James, Roanoke, and Pee Dee Rivers of the Middle Atlantic Drainage Basin; the Clinch and

Holston of the Tennessee Basin; and the Kanawha and Big Sandy of the Ohio Basin depend, at least in part, on the water runoff from this region. Unfortunately, much of the vegetative cover is inadequate for the control of excessive run-off from the area. In the Potomac watershed, less than one-half of the cover on forest land and one-third of that on the open land is fully effective in retarding run-off and waterflows. The condition of the remaining cover--due to forest fires, overgrazing, excessive cutting, or a general lack of soil and water conserving practices--is such that at best it is only partially effective. Studies and observations by the Department of Agriculture show that similar conditions are prevalent on the Pee Dee, Roanoke, and Kanawha Headwaters, indicating that deteriorated watershed conditions are widespread.1/

The climate is well suited to forest growth and sufficiently moderate so that timber cutting is possible the year around. The growing season ranges from about 140 days at the higher elevations to 180 days at the lower. Average rainfall ranges from 35 to 50 inches per year. June, July, and August are the months of greatest rainfall. Summer temperatures in the Great Valley average about 75° F. and are proportionately lower at higher elevations. Although zero weather is frequent during the winter months, snowfall is not heavy, averaging 25-30 inches annually. In most places the snow melts in a few days after falling.

ECONOMY OF THE REGION

Population

According to the 1940 Census, 848,000 people reside within the mountain region, representing an increase of about 12 percent since 1930. Approximately 40 percent live on farms, 35 percent are rural non-farm residents, and the remainder, 25 percent, are urban dwellers.

In 1940, gainfully employed workers numbered 253,600 or 30 percent of the population. Agriculture (69,000), service industries (46,000), and manufacturing (45,000) were the principal sources of employment--together engaging about 63 percent of the total workers. Other important activities include retail trade, transportation and communications, and coal mining--each employing about 10 percent.

Agriculture

Livestock, yielding about 23.1 million dollars in 1939, is the chief source of agricultural income. The annual income from cultivated crops amounts to about 10.6 million dollars, and forest products yield about $623,000 or $10 per farm.

Poultry raising is also an important farm enterprise in the region. About 30 percent of the 1939 farm income from livestock was obtained from

1/Unpublished data of the U.S.D.A. Flood Control Surveys and Examinations.

poultry and poultry products. Rockingham County leads in poultry production, and is considered one of the leading poultry centers of the United States. In 1940, this county alone used about 23,000 standard cords of wood for heating poultry brooders. In addition, the poultry are marketed in wooden coops supplied by small plants located just east of the Blue Ridge.

Agricultural wealth is largely concentrated within the limestone soil areas of the Great Valley. Relatively high values of the Valley section raise the average of farm income and farm values of the mountain region on a par with the general average for the State. According to the Census, the average value of farm land and buildings in 1939 was $4,240 per farm, or $400 in excess of the State average. In the same year, the total value of farm products sold, traded, or used averaged $812 per farm--about $60 less than the State average. It is important to note, however, that on one-fourth of the farms the 1940 production was valued at less than $250. Incomes such as these are hardly enough to pay farm operating expenses, and most certainly are inadequate for the maintenance of a proper diet or adequate housing and sanitary facilities.

Manufacturing and Mining

In 1939, the State Chamber of Commerce[1/] reported 251 manufacturing plants in the region, each engaging 25 or more workers. By major industrial groups, the plants are listed below:

	Number of Plants
Textiles and textile products	73
Food and kindred products	54
Forest products industries	37
Stone, glass, and clay products	30
Chemicals and allied products	12
Miscellaneous industries	45
Total	251

Of the 45,000 workers employed in manufacturing plants of all sizes, textile mills employed 31 percent, chemical plants 22 percent, forest products industries 21 percent, and various other plants employed the remainder, or 26 percent. The total value of the products manufactured exceeded 165 million dollars[2/] in 1937.

Further evidence of the varied economy of the area is found in the number of productive coal mines operating in the region. In Buchanan, Dickenson, Lee, Montgomery, Pulaski, Russell, Tazewell, and Wise Counties over 80 mines are in operation. Approximately 20,000 workers are employed by the industry. In 1940, almost 15 million net tons of coal were produced (within the above counties), ranking the State as seventh in coal production. Estimates[3/] show over 30 billion tons of coal remaining in the mountain

1/Directory of Virginia Industries, Virginia State Chamber of Commerce, Dec. 1939, 18 p., mimeographed.

2/Biennial Census of Manufactures, Part I, Bureau of the Census, 1941.

3/Virginia Geological Survey Bulletins 12,18,19,20,22,24, and 26.

region. Therefore, at the current rate of mining, many years will be required to exhaust the known supply.

The coal mining industry's need for props, wedges, caps, cross bars, ties, and miscellaneous lumber furnishes a reliable market for wood products. Investigations by the Forest Survey show that in 1940 this industry used approximately 77,000 standard cords and 23 million board feet of wood for the above purposes.1/ Over 70 percent of the wood used came from the Virginia mountain region.

Forest Land Ownership

Forest land ownership is almost equally divided among farm, non-farm private, and public agencies. In 1940, non-farm private interests controlled 1.9 million acres, farmers owned 1.7 million acres, and public agencies had title to 1.4 million acres. Public ownership of forest land dates back to about 1913 when the initial tracts of national forest land were acquired under the authority of the Weeks Law. As a result of subsequent purchases, the largest, contiguous tracts of forest land under one ownership are contained in the George Washington and Jefferson National Forests. Coal companies control the largest tracts of forest in private ownership--a number of which exceed 10,000 acres. Farm woodland ownership seldom exceeds several hundred acres per farmer.

Land Use

Practically the entire region originally was forested. Land clearing for agricultural, industrial, and other urban or rural developments has created about 4.1 million acres of non-forest land (table A-1)2/. Approximately 5.0 million acres are still forested and devoted to forest uses.

In the non-forest area agricultural use predominates, occupying 3.9 million acres, or 93 percent of the total. The importance of livestock in the agricultural economy is emphasized by the relatively large area (2.2 million acres) in pasture. Cultivated land, a large part of which is devoted to the production of feed for livestock, comprises about 1.7 million acres. Abandoned land, consisting largely of worn-out crop-land, is estimated at only 78,000 acres. Towns, rights-of-way, farm homesites, and waterways occupy about 200,000 acres.

With the exception of about 184,000 acres, largely on the upper portions of major ridges, all of the forest land can produce saw timber. About 107,000 acres, the area contained in State and Federal parks, are restricted to recreational and watershed protection uses. The George Washington and Jefferson National Forests combine timber production with recreation, watershed protection, and other uses on the 1.3 million acres

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1/Based on factors of 0.33 cu. ft. of rough wood and 1.55 bd. ft. of lumber per ton mined. Cubic feet converted to cords using factor of 64 cu. ft. per cord.

2/Table numbers prefixed with letter A indicate tables are in appendices.

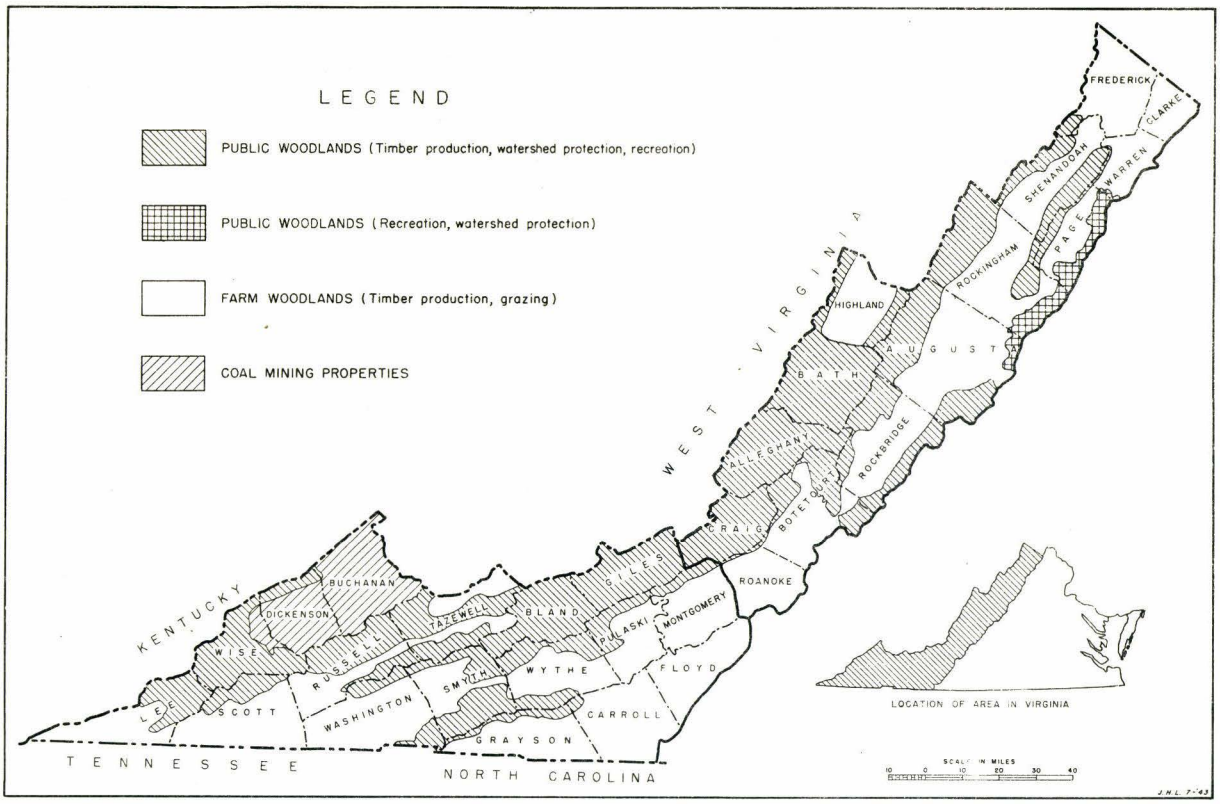

Figure 2. - The major uses of forest land within the Mountain Region of Virginia.

of forest land within their boundaries and under their administration. In general, timber growing is considered the primary use of productive private forest land, although in some farm woodlots grazing use may predominate. The major uses of forest land are delineated roughly in figure 2.

DESCRIPTION OF THE FOREST RESOURCE

The original forest of the mountain region in Virginia contained a wealth of timber including oak, chestnut, yellowpoplar, hickory, basswood, walnut, white pine, and many other species of relatively large size and high quality. At least 45 billion board feet of merchantable timber were available to the logger. Since settlement, however, the former permanent timber types have been changed to more or less unstable types dominated by inferior species. Forest fires, lumbering, land clearing, and disease have been the principal factors effecting this change.

The present forest is largely second-growth, of seedling or multiple sprout origin, containing a scattering of holdovers from the original stand. Small sizes and low quality characterize the saw timber. The present board-foot volume is about one-tenth that of the original stand. For the most part, the forest is confined to the hills and ridges whose poor soils have been rendered still less productive by repeated fires.

Species

At least 50 tree species of commercial value grow within the 4.7 million acres[1] of commercial forest land. Measured in terms of sound cubic volume contained in trees over 5.0 inches d.b.h., hardwood species form over four-fifths of the present forest (fig. 3 and table A-2). The remainder of the forest consists of softwood species, principally pine.

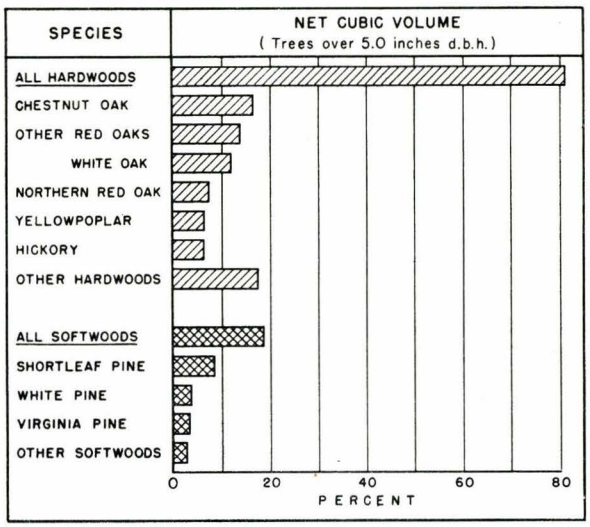

Figure 3. - Species composition of the forest, 1940.

Chestnut oak is the most abundant of all species, comprising one-third of the oaks, which in turn constitute almost two-thirds of the hardwoods. This preponderance of chestnut oak can be largely attributed to its superior sprouting capacity, its resistance to destruction by fire, and its adaptability to a variety of sites, especially on the thin soils of the mountain slopes. Northern red oak and white oak, which represent the better species, comprise only 15 percent and 24 percent, respectively, of the oaks. The remainder of this species group, or about 28 percent of the total, consists of black, southern red, scarlet, pin, and post oaks in varying proportions.

Yellowpoplar and the hickories are the most abundant of the hardwoods except for the oaks. Together these species, in equal proportion, form about 16 percent of the hardwood forest. Chestnut, which probably was the predominant species of the old-growth forest, no longer exists as measurable live volume because of the chestnut blight. The proportions of other species contained in the hardwood forest are given in table A-2.

The commercial softwoods are composed of 8 species of which two, red spruce and redcedar, are found in relatively small amounts. The shortleaf pine group, consisting of pitch, table mountain, and shortleaf pines, comprise almost one-half of the softwood component of the forest. White pine, Virginia pine, and hemlock, in order of abundance, constitute the remaining softwood species.

1/Does not include public reserved forest (107,000 acres) principally in Shenandoah National Park, and non-commercial forest (184,400 acres). Cutting is prohibited in the former area and merchantable saw timber will not grow in the latter. Therefore, both classes of forest are not included in this or subsequent discussions and tables of area and volume.

Forest Types

Both the hardwoods and softwoods of the region are found in many associations, ranging from pure stands of a single species to complex combinations of a dozen or more kinds of trees. For the purpose of concise presentation, however, the many possible combinations of species can be classified into five broad types: mountain hardwoods, cove hardwoods, shortleaf-pitch pine, Virginia pine, and white pine (fig. 4).

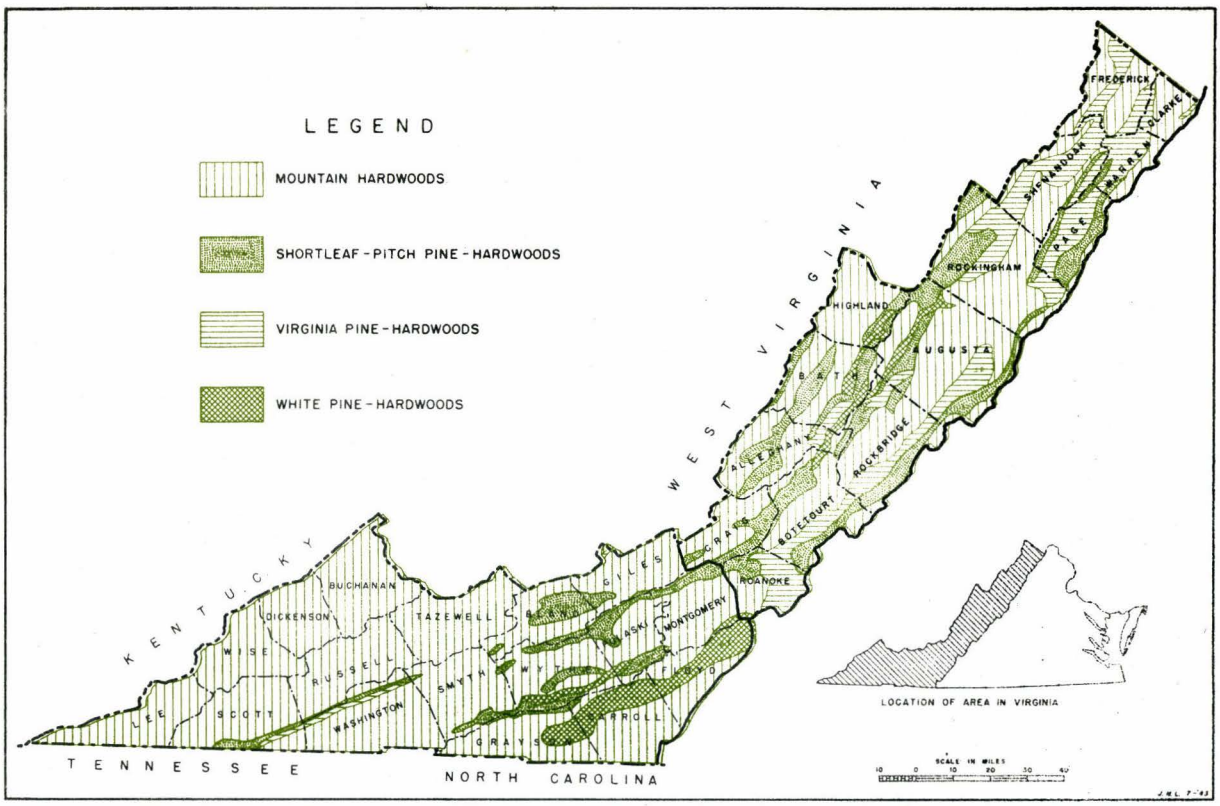

Figure 4. - Major forest types in the Mountain Region of Virginia. 1/

The mountain hardwood type is most prevalent, covering 3.2 million acres or over two-thirds of the area in forest (table A-3). As the name implies, the type is common to the mountain slopes and ridges although, to a certain extent, it encroaches into the valleys. The various species of oak usually predominate, but in small areas associated species such as hickory, yellowpoplar, black locust, black gum, maple, or pine may be more numerous. Chestnut oak is the most abundant oak, although black, scarlet, northern red, and white oak are common.

Slightly less than 10 percent, or 435,000 acres, is occupied by the cove hardwoods. This type is found on the deep, moist soils of the lower mountain slopes and the coves of small streams, particularly those extending up the northern slopes. Because of almost ideal growing conditions, dense stands composed of fast growing, straight stemmed trees are typical

1/Cove hardwoods are found in areas too small to be shown on map.

of the type. The valuable yellowpoplar is, by far, the most prevalent species. Northern red oak, basswood, sugar maple, hickory, birch, white oak, and black locust--to name a few species--are also common.

Shortleaf-pitch pine, covering about 529,000 acres or 11 percent of the forest land, is dominant among the softwood types. Included are the shortleaf pine of the valleys and the pitch and table mountain pines of dry slopes and ridges. Pure stands, especially of table mountain or pitch pine, are frequent. Chestnut oak is a principal associate of pitch and table mountain pine; other oaks such as scarlet, black, and southern red oaks are often found in mixtures with shortleaf.

Approximately 285,000 acres or 6 percent of the forest consists of the Virginia pine type. It is usually found on poor soils at elevations below 3,000 feet, and to a large extent consists of Virginia pine in pure stands which have sprung up on farm land abandoned during or since the Civil War. On ridges, the type frequently consists of an association of Virginia, pitch, and table mountain pines, and on dry south or west slopes it is formed of a mixture of pine and miscellaneous oaks.

The white pine type, including approximately 71,000 acres of hemlock-hardwood and 3,000 acres of spruce-fir, occupies about 200,000 acres or 4 percent of the forest land. The hemlock-hardwood forest chiefly occurs in the coves of small mountain streams and over a widely scattered area. The spruce-fir forest is confined to the tops of high mountains and is principally in small areas located in Highland, Smyth, Tazewell, and Grayson Counties. The white pine, in association with mixed hardwoods, is scattered throughout the region, with a rather extensive area in Grayson, Carroll, and Floyd Counties. White pine and hemlock constitute the principal softwoods in the type and the red and white oaks the chief hardwood associates.

Forest Condition

Past management of the forest resource is well reflected in the present condition of the forest cover. The bulk of the area, about 4.6 million acres, is now composed of second-growth stands, and only 0.1 million acres remain in old growth (table A-3). Of the second-growth area, about 40 percent is in the saw timber condition, 57 percent is cordwood, and only 3 percent is reproduction. Figure 5 shows the relative proportion of the various forest conditions by types.

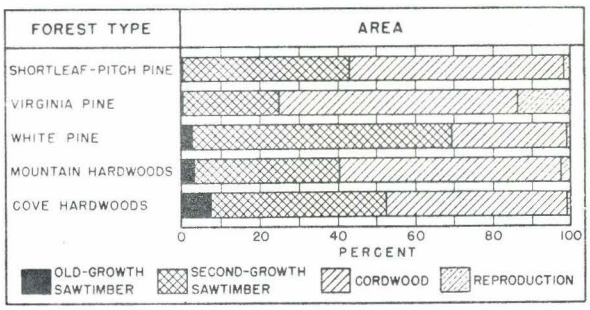

Figure 5. - Forest area by types and conditions, 1940.

The saw timber areas, totaling 2.0 million acres, consist of all forest lands containing sufficient hardwoods of over 13.0 inches d.b.h. or softwoods of over 9.0 inches d.b.h.

to yield a volume of at least 600 board feet (Int. $\frac{1}{4}$")[1] per acre. For the most part, the old growth stands in this category are contained in small scattered tracts, many of which are more or less inaccessible or do not contain a sufficient volume of desirable species to warrant cutting. Second growth saw timber stands are distributed somewhat uniformly over the region with a slightly larger area located in the southern part. Almost two-thirds of total saw timber area is contained in the mountain hardwood type (table A-3).

The cordwood and reproduction stands, aggregating 2.7 million acres,[2] are found throughout the region. The mountain hardwood type predominates in these condition classes too, occupying almost three-fourths of the total area. Many of these areas have been cut over several times. This is especially true in the vicinity of the coal fields where mine timbers have been in heavy demand, and in localities once occupied by iron furnaces where blocks of several thousand acres or more have been clear-cut repeatedly for charcoal.

Site Quality

Although the general climate is favorable to forest growth, other factors such as soil, aspect, and elevation are of such a nature that forest productivity is quite varied. Good sites, or areas that are capable of producing mature hardwood trees containing 3 or more sawlogs or yellow pines of 4 or more logs, are found on less than 3 percent of the forest land. Most of the forest, or 74 percent, is of a medium site quality, and is able to produce hardwoods of $1\frac{1}{2}$ to 3 log lengths or pines of 2 to 4 logs. The remainder of the area, or 23 percent, is classed as a poor site which at best is capable of bearing only $1\frac{1}{2}$ log hardwoods and 2 log pines. Generally speaking, the good sites are confined to the coves of small streams and moist fertile benches on north and east slopes. Medium sites are usually on the lower slopes and broad benches, and on the upper north and east facing slopes. The preponderance of the poor sites are on ridges and on upper slopes, especially those of eastern or southern aspects. In some cases, locations having the general physical characteristics of better sites because of fire or other past abuses are of low productivity.

As would be expected, the largest acreage of good site quality is in the cove hardwoods type. The smallest acreage is in the Virginia pine and shortleaf-pitch pine types. Medium sites predominate in all but the shortleaf-pitch pine type, which has slightly over one-half of its area on poor sites.

1/The International $\frac{1}{4}$" rule gives the closest approximation of the actual green lumber content of standing trees. Therefore all subsequent tables and discussions of board foot volume are based on this rule, unless otherwise stated.

2/Includes 9,000 acres of clear-cut area.

VOLUME OF THE FOREST RESOURCE

Board Foot Volume

The total net saw timber volume in 1940 approximated 5.7 billion board feet, as measured by the International ¼-inch rule. Estimates by the Scribner and Doyle rules showed lesser volumes of 5.1 and 4.1 billion board feet, respectively (table A-4). The above quoted volumes are those contained only in the sawlog portions of hardwood trees of at least 13.0 inches d.b.h. and softwoods 9.0 inches d.b.h. and over. Although sawlogs are often cut from trees of smaller sizes, this practice is considered financially unsound and, therefore, the volumes contained in these trees were not included in the estimates of board measure. Defective material ordinarily left in the woods or that which would cause a reduction in the amount of sawed lumber was also excluded from the above estimates.

Per acre: A low average volume per acre clearly shows the depleted condition of the forest resource. The present stand contains only 1,070 board feet per acre (tables 1 and A-5) as compared with a State average of 1,690 board feet and that of the original forest of at least 5,000 board feet. The heaviest average volume per acre (2,820 board feet) is found in

Table 1. - Average board foot volume per acre, International ¼-inch rule, by forest type and forest condition, 1940.1/

Forest type	Saw timber stands			Cordwood and reproduction stands	All conditions
	Old growth	Second growth	Average		
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.
Shortleaf, pitch pine	2,690	1,580	1,590	160	780
Virginia pine	-	2,130	2,100	110	610
White pine	10,630	3,640	3,930	320	2,820
Mountain hardwoods	4,430	2,040	2,220	130	980
Cove hardwoods	4,180	2,590	2,810	180	1,570
All types	4,580	2,160	2,330	140	1,070

1/Dead chestnut is not included.

the white pine type. Cove hardwoods, containing the second heaviest stand, averages only 1,570 board feet. Mountain hardwoods, by far the most prevalent type, is a poor third with only 980 board feet to the acre. The poverty of this latter type is only exceeded by that of the Virginia and shortleaf-pitch pine types.

By species: Of the 5.0 billion board feet inventoried in 1940, three-fourths was hardwood (fig. 6 and table A-6). Two-thirds (2.5 billion bd. ft.) of the hardwood volume consists of the oaks. Chestnut, white, and northern red are the principal oaks of saw timber size. Prominent among the remainder of the live hardwoods are yellowpoplar with a volume of about 0.3 billion board feet, and hickory with 0.2 billion feet. Among the softwoods, shortleaf-pitch pine with 42 percent of the board foot volume, white pine with 27 percent, and hemlock-spruce with 20 percent are most prevalent. Of the once abundant chestnut, there remains about 0.8 billion board feet in dead but sound trees.

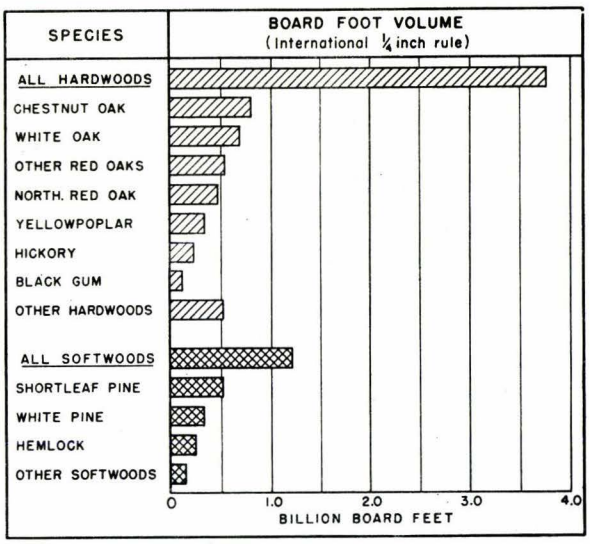

Figure 6. - Volume of saw timber in living trees by species, 1940.

By condition: Most of the board foot volume, or 79 percent, is contained in second-growth saw timber stands. Only 13 percent is in old growth and a still smaller amount, or 8 percent, is in the cordwood areas (tables 2 and A-7). The volume contained in the old growth stands becomes still less important because, as previously mentioned, it is largely contained in small, scattered tracts or areas that are more or less inaccessible. To a large degree, the saw timber in the cordwood stands is not available inasmuch as the volume per acre is too small to be harvested profitably. Hence, it is quite obvious that commercial logging operations, in most cases, are restricted to the working of second-growth saw timber stands.

Table 2. - Net board foot volume, International ¼-inch rule, by forest type and forest condition, 1940.1/

Forest type	Saw timber stands		Cordwood and reproduction stands	All conditions	
	Old growth	Second growth			
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	Percent
Shortleaf, pitch pine	4,300	359,200	49,100	412,600	8.3
Virginia pine	-	150,400	23,900	174,300	3.5
White pine	60,600	484,500	19,700	564,800	11.3
Mountain hardwoods	441,000	2,448,400	253,000	3,142,400	63.2
Cove hardwoods	133,900	510,100	37,700	681,700	13.7
All types	639,800	3,952,600	383,400	4,975,800	100.0

1/Dead chestnut, amounting to 208.2 million board feet in the Northern Unit and 550.2 million board feet in the Southern Unit, is not included.

The leading species in the saw timber conditions is chestnut oak with 760 million board feet. Among the more prevalent of the better quality hardwoods are northern red oak, white oak, and yellowpoplar--together totaling 1,451 million board feet, or about one-third of the volume in the saw timber stands. The shortleaf-pitch pine species group and white pine predominate among the softwoods with volumes of 414 and 302 million board feet, respectively.

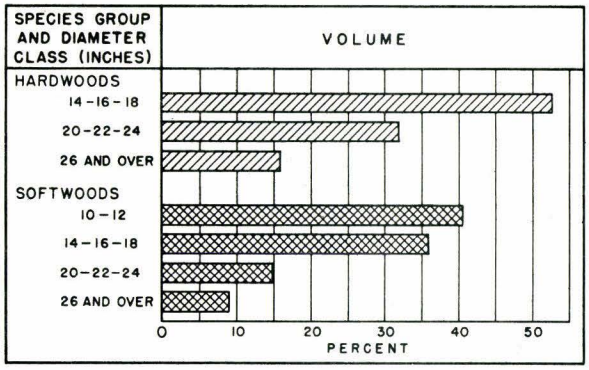

Figure 7. - Distribution of net board foot volume by species group and diameter class, 1940.

By diameters: Of the board foot volume in softwoods, three-fourths is in trees under 19.0 inches d.b.h. and over one-half of that is in trees under 13.0 inches d.b.h. (fig. 7 and table A-8). Small sizes are common to the hardwoods also, with almost one-half of their volume in trees under 19.0 inches d.b.h. Thus, the average logging operator of the region is confronted with saw timber stands containing a preponderance of trees of small diameters. Therefore, the profit margin is narrow because small trees are more expensive to log and transport and generally yield logs of lower grades. Mill profits are affected also inasmuch as the small logs yield less lumber per unit of cost and the quality of lumber is usually low.

By volume-per-acre class: The large area and volume of second growth is evidence that practically all of the saw timber, as in the past, is accessible topographically to the present-day operator. A greater obstacle to profitable logging than topography is the large area of saw timber containing a relatively low board foot volume. Sixty-one percent of the softwood area and about the same proportion of that in hardwood--together containing about 30 percent of the volume--are in stands of less than 2,000 board feet to the acre (fig. 8). Many lumbermen consider that an operable stand should average at least 2,000 board feet to the acre. If this is accepted as the minimum for a profitable logging operation, then only two-fifths of the saw timber area falls in that category. Fortunately, 70 percent of the present saw timber volume is contained in this area.

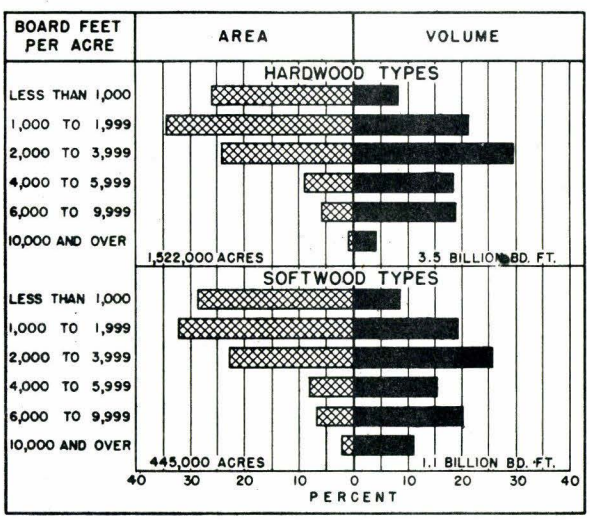

Figure 8. - Distribution of area and board foot volume (Int. $\frac{1}{4}$-in. rule) in the saw timber conditions by volume-per-acre class, 1940.

Cordwood Volume

Inasmuch as 58 percent of the forest is in cordwood or reproduction conditions and a great many of the trees in the saw timber areas are less than sawlog size, the cordwood inventory presents a more comprehensive measure of the forest resource.

Cordwood as defined by the Forest Survey includes the sound volume (wood and bark) of trees 5.0 inches d.b.h. and larger including culls. The cordwood volumes measured were the sawlog portion of all saw timber trees, the upper stems of softwood and the upper stems and limbs of hardwood saw timber, and the stems of all trees of less than saw timber size.

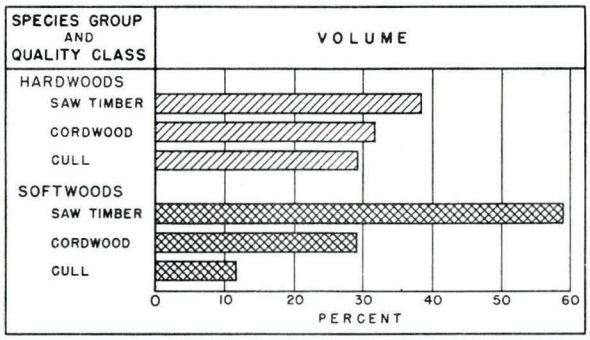

Figure 9. - Distribution of total cordwood volume by tree quality class, 1940.

By quality class: The total net volume of all trees 5.0 inches d.b.h. and larger, including the dead chestnut, which amounts to 6.7 million cords, is 54.6 million cords (table A-9). Excluding chestnut, the net volume is 47.9 million cords; 41 percent in the stems and upper limbs of sawlog trees, 32 percent in the stems of smaller trees, and 27 percent in cull trees of both size classes (fig. 9).

By species: Softwoods comprise only 13 percent of the sound live cordwood volume (table A-9). About 3.0 million cords are of the shortleaf-pitch pine species group, 1.3 million are Virginia pine, 1.2 million white pine, and almost 1.0 million of miscellaneous species, mostly hemlock.

Hardwoods make up the remaining sound volume in living trees, or 87 percent of the total. About 26.0 million cords consist of oak, of which 41 percent is chestnut oak. Hickory (3.0 million cords), yellowpoplar (2.8 million cords), red maple (1.3 million cords), and blackgum (1.1 million cords) are dominant among the remaining species. As an indication of the species distribution of future hardwood saw timber, it is noteworthy that the better quality species such as northern red oak, white oak, yellowpoplar now in cordwood stands total only 3.3 million cords, while the poor quality species such as chestnut oak, blackgum, red maple, and miscellaneous red and white oaks[1/] total 6.0 million cords.

By diameter class: The net cordwood volume in sound trees, excluding all culls and the upper stems and limbs of saw-timber-size hardwoods, totals 34.1 million cords. Of this volume, 5.7 million cords are of

1/Black, scarlet, southern red, pin, and post oaks.

softwood species, 23.7 million of live hardwoods, and 4.7 million of dead chestnut (table A-10). A large part of this volume is in trees of small diameters. About two-thirds of that in softwoods and over one-half of that in live hardwoods is in trees under 13.0 inches d.b.h. (fig. 10). However, in the case of dead chestnut and certain individual live species such as white pine, hemlock, northern red oak, white oak, blackgum, and sugar maple the greater part of the cordwood volume is in larger trees.

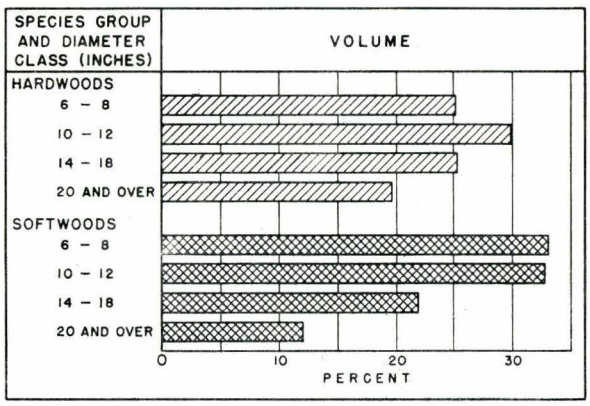

Figure 10. - Distribution of net cordwood volume in sound trees by diameter class, 1940.

Volume per acre: The average volume per acre in sound, living trees is 6.3 cords. Saw timber stands average 10.5 cords, ranging from 10.2 cords in second growth to 14.8 in old growth (table A-11). With the exception of shortleaf-pitch pine (8.1 cords) all types in the saw timber conditions average over 10.0 cords per acre--the heaviest stand, 14.4 cords, being in the white pine type. The cordwood and reproduction conditions, together average only 3.2 cords per acre.

Cubic Foot Volume

Cubic foot volumes as measured by the Forest Survey are on the same basis as cordwood except that the bark of trees is not included.

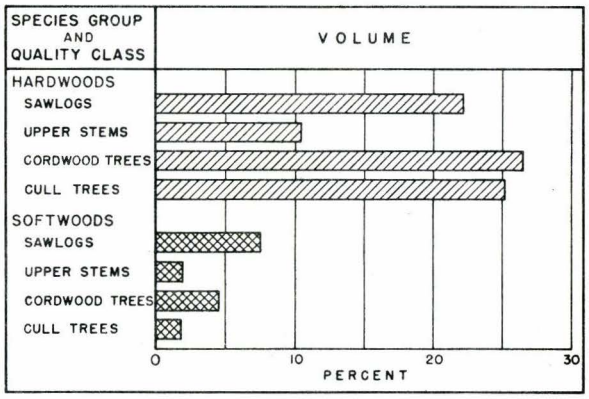

Figure 11. - Cubic volume by species group and quality class, 1940.

The total net volume of the sound wood in all living trees, including culls, is 3.1 billion cubic feet (table A-12), of which 84 percent is hardwood and only 16 percent softwood (fig. 11). About three-fifths of the softwood volume is in saw timber trees as compared with about two-fifths of that in hardwoods. The remaining hardwood volume is about equally divided between that in cordwood trees and that in culls. Cull trees constitute only about one-tenth of the softwood cubic volume.

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Inasmuch as 58 percent of the forest is in cordwood or reproduction conditions and a great many of the trees in the saw timber areas are less than sawlog size, the cordwood inventory presents a more comprehensive measure of the forest resource.

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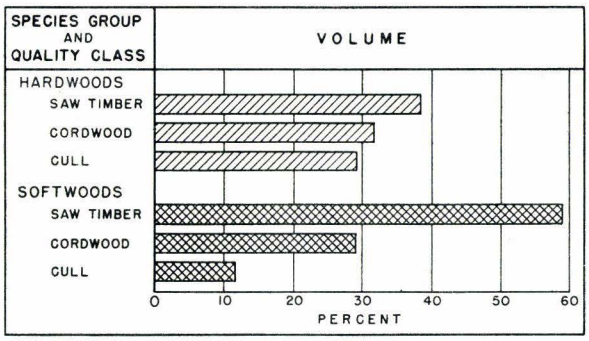

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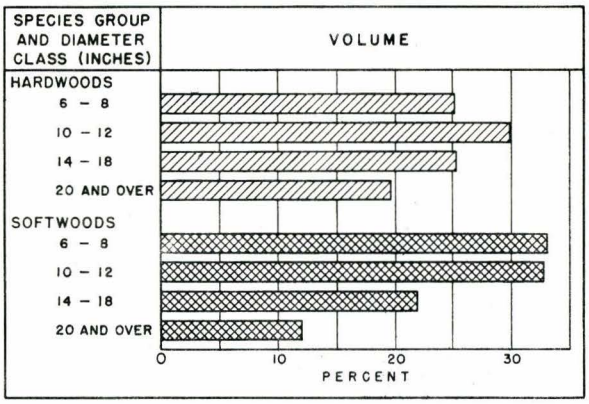

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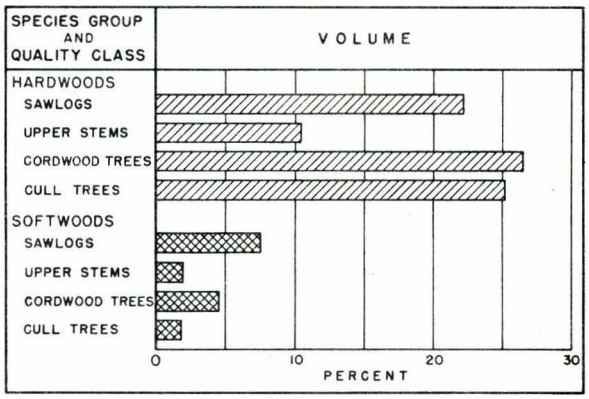

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Supply of All Material

In table 4, the previously described board foot, cordwood, and cubic foot volumes are interpreted in terms of usable forest products. Two points should be kept in mind when studying this table. First, no attempt was made to assign each kind of timber to a separate use; for example, oaks of a size suitable for tie timber are also usable as saw timber and are included in the inventory of both products. Secondly,

Table 4. - Inventory of the forest resource by products.

Species group and products	Source of products	Quantities of most common species	Total quantities of all species	Percent of total volume in cords, trees 5" d.b.h. and over
HARDWOODS				
Saw timber	Sound trees of all species 13.0" d.b.h. and over.	Chestnut oak - 804,000 M bd.ft. White oak - 696,300 M bd.ft.	4,514,300 M bd.ft.	24
Veneer timber	Sound trees 16.0" d.b.h. and over of common veneer species.	White oak - 607,400 M bd.ft. Yellowpoplar - 58,600 M bd.ft.	1,604,000 M bd.ft.	7
Tie timber	All sound oak 13.0" d.b.h. and over.	Chestnut oak - 17.9 million pieces White oak - 15.5 million pieces	56.1 million pieces	10
Mine props	Sound trees of all species 7.0" d.b.h. and over.	Chestnut - 213.5 million pieces Chestnut oak - 180.8 million pieces	1,054.5 million pieces	48
Fuel wood	All chestnut, and of the suitable fuel-wood species the sound volumes in cull trees, the stems of trees 5.0" to 13.0" d.b.h. and the upper stems and limbs of trees 13.0" d.b.h. and over.	Chestnut oak - 8.2 million cords Chestnut - 6.7 million cords	32.5 million cords	60
Fence posts	All sound chestnut, red cedar, black locust, and sound white oaks 5.0" to 13.0" d.b.h.	Chestnut oak - 564.0 million pieces White oak - 351.3 million pieces	1,016.9 million pieces	22
Pulpwood	Trees 5.0" to 13.0" d.b.h., upper stems and limbs of trees 13.0" and over d.b.h. and the usable volume in cull trees of all pulping species.	Chestnut - 3.7 million cords Yellowpoplar - 1.7 million cords	7.6 million cords	14
Specialty woods	All sound volume of black locust, dogwood, persimmon, and mulberry 5.0" and over d.b.h.	Black locust - 1,096.0 M cords Dogwood - 37.3 M cords	1,149.4 M cords	2
Tan bark	All chestnut oaks 13.0" d.b.h. and over.	Chestnut oak - 1.8 million tons	1.8 million tons	9
Chestnut acid wood	All dead chestnut 5.0" d.b.h. and over.	Chestnut - 6.7 million cords	6.7 million cords	12
SOFTWOODS				
Saw timber	Sound trees 9.0" d.b.h. and over.	Shortleaf pine - 509,600 M bd. ft. White pine - 328,300 M bd.ft.	1,219,900 M bd.ft.	7
Pulpwood	Trees 5.0" to 9.0" d.b.h., upper stems of trees 9.0" d.b.h. and over, and usable volume in cull trees of all species.	Shortleaf pine - 1.5 million cords Virginia pine - 0.8 million cords	3.0 million cords	5
Tan bark	All hemlock 9.0" d.b.h. and over.	Hemlock - 0.2 million tons	0.2 million tons	1

practically all of the growing stock of a size and kind that can be converted into one or more products is represented in the inventory. Hence, the removal of all or a greater part of the products listed will result in an almost complete devastation of the forest unless the cutting is spread over a period long enough to enable adequate replacement from the small tree growing stock. In this latter connection, the principal concern should be for the trees of high value but of a low inventory as, for instance, those from which veneer logs may be cut. Trees of this size and kind comprise only 7 percent of the volume in trees 5.0 inches d.b.h. and larger. Therefore, it is obvious that a maintained rate of cutting in excess of replacement will soon exhaust the supply of veneer-quality trees. Conditions such as these add importance to the smaller diameter trees and serve to point out that most of the small trees may have a higher value as growing stock--to be reserved for the future production of larger size timber--rather than to be utilized in the form of a low-value product.

FOREST GROWTH

In assembling the 1940 growth data for the mountain region, it was found that 52 percent of the volume increase in board feet and 37 percent of that in cords come from trees which in the previous year were below saw timber or cordwood size. This fact serves to emphasize the importance of the small diameter trees in the growing stock. Obviously a large potential volume is destroyed when small, fast growing trees are eliminated by cutting, fire, or other causes.

The growth rate in the mountains was found to be less than that of other regions in the state. In 1940, net growth amounted to 4.8 percent of the saw timber stand as compared with 8.3 and 6.4 percent, respectively, in the Piedmont and Coastal Plain. In the case of the total growing stock, 5 inches and over d.b.h., net growth also amounted to 4.8 percent in the mountains, but in the Piedmont equalled 6.1 percent and in the Coastal Plain 5.2 percent. The somewhat slower growth rate in the mountains is chiefly the result of a greater proportionate area of poor soils, poorer stocking, and the prevalence of species such as chestnut oak and hickory which are slower growing than the pines of the Coastal Plain and Piedmont.

Growth in Board Feet

In 1940, net growth--the increase in volume of growing stock deducting for mortality but not for volume cut--was 238.2 million board feet (tables 5 and A-13). Mortality losses from disease, insects, fire, wind, suppression, and other causes amounted to about 23.0 million board feet. Approximately three-fourths of the board foot increase was hardwood, chiefly (57 percent) oak. Shortleaf pine produced the largest proportion (37 percent) of the softwood saw timber growth. As demonstrated in the following tabulation, the volume increase in small diameter trees, especially in softwoods, was substantially greater than that in large trees:

Table 5. - Net increment by species group and class of material.

Species Group	Saw timber	All sound trees 5.0 in. d.b.h. and larger	
	M bd.ft.	Cords	M cu.ft.
Softwoods			
Shortleaf pine	21,400	90,600	6,490
Virginia pine	16,300	104,900	7,890
Others	20,200	76,900	5,980
All softwoods	57,900	272,400	20,360
Hardwoods			
Oaks	102,400	565,800	35,480
Gums-yellowpoplar	32,900	141,900	9,060
Others	45,000	396,800	25,220
All hardwoods	180,300	1,104,500	69,760
All species	238,200	1,376,900	90,120

	D.B.H. class - inches			
	10-12	14, 16, & 18	20 & over	All classes
	Percent	Percent	Percent	Percent
Hardwoods - - - - - -	-	56	44	100
Softwoods - - - - - -	54	31	15	100

Growth in Cords

The net growth of all sound trees 5.0 inches d.b.h. and larger amounted to 1.4 million cords after a deduction of 125,000 cords for mortality (tables 5 and A-14). Four-fifths of the net growth in cords was in hardwood and the balance softwood. Fifty-one percent of the hardwood growth was from the oaks. Most of the softwood growth was from Virginia and shortleaf pines, these species producing 38 and 33 percent, respectively, of the total. Small diameter trees as shown in the following tabulation contributed a greater part of the cordwood increase:

	Diameter class - inches				
	6-8	10-12	14, 16, & 18	20 & over	All classes
	Percent	Percent	Percent	Percent	Percent
Hardwoods - - -	35	18	27	20	100
Softwoods - - -	31	40	21	8	100

Net Growth Per Acre

The net growth on the 2.0 million acres in saw timber stands averaged about 84 board feet per acre annually (tables 6 and A-16). Approximately 79 percent of this annual increase was hardwood of which 58 percent was oak and the remainder of miscellaneous hardwood species. The saw timber stands of the white pine and cove hardwood types produced the most net growth per acre, about 120 board feet, but this average applied only to an area of 368,000 acres. Mountain hardwoods, the most prevalent type (1.3 million acres) in the saw timber condition, produced only 78 board feet per acre.

Table 6. - Average net growth per acre in saw timber stands by forest types and species groups.

Forest types	Softwoods	Hardwoods	All species
	Bd.ft.	Bd.ft.	Bd.ft.
Shortleaf-pitch pine	44	9	53
Virginia pine	87	21	108
White pine	81	40	121
Mountain hardwoods	6	72	78
Cove hardwoods	4	116	120
All types	18	66	84

The cordwood area, 2.7 million acres, had an average annual net growth of 0.28 cords per acre (tables 7 and A-16). As expected, the best growth (one-half cord per acre) was in the cove hardwood type which, in the cordwood condition, occupied only 205,500 acres. The poorest growth occurred in the cordwood stands of the shortleaf-pitch pine, averaging about 0.2 cords over a total area of 300,500 acres. The mountain hardwood type, occupying almost three-fourths of the cordwood area, had an average net growth of approximately 0.3 cords per acre.

Table 7. - Average net growth per acre in cordwood stands by forest types and species groups.

Forest types	Softwoods	Hardwoods	All species
	Cords	Cords	Cords
Shortleaf-pitch pine	.13	.04	.17
Virginia pine	.22	.07	.29
White pine	.19	.21	.40
Mountain hardwoods	.02	.24	.26
Cove hardwoods	.01	.49	.50
All types	.05	.23	.28

PRIMARY FOREST INDUSTRIES

The Lumber Industry

Number, size, and location of mills: In 1940, there were about 1,000 sawmills operating in the Mountain Region of Virginia. As shown in the following tabulation the majority of these mills were small and of a limited daily capacity:

Number of mills	Capacity class (M bd. ft. daily)	Average daily capacity (M bd. ft.)
982	1 - 9	2.85
11	10 - 19	10.85
6	20 and over	33.85
999	---	3.91

Three-fifths of the total number of mills were located in Unit 5 or the southern part of the region. The smaller mills (1-9 thousand board foot capacity) were found throughout the region, but especially heavy concentrations occurred in Shenandoah, Frederick, and Highland Counties of Unit 4, or the northern part of the region, and in Floyd, Carroll, and Grayson Counties in the southern part (fig. 12). All but three of the mills in the

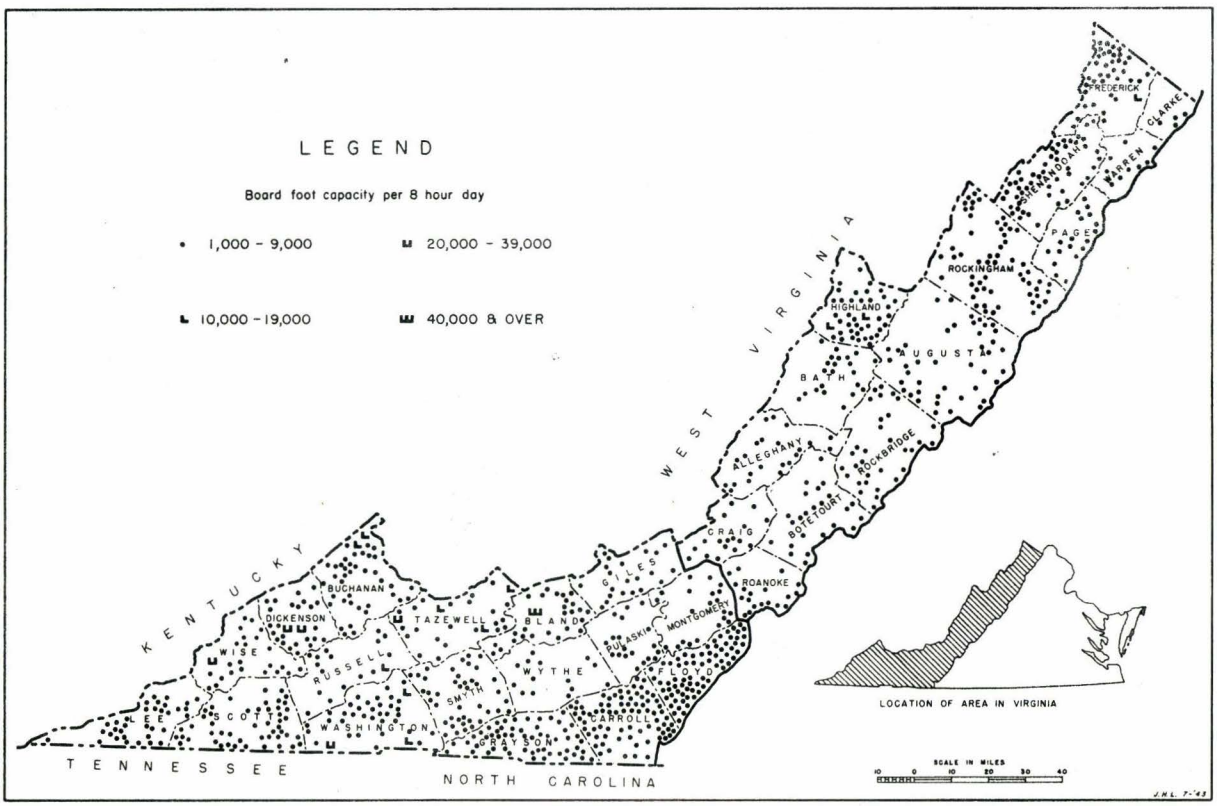

Figure 12. - Sawmills in the Mountain Region of Virginia, 1940.

10 to 19 thousand board foot capacity class and all of the larger capacity mills were located in Unit 5.

Production and sources of material: Total lumber production in 1940, including timbers and sawed ties, amounted to 197.5 million board feet (table A-17). As shown in table 8, over two-thirds of the total production was by mills sawing less than 10,000 board feet per day. Eighty-one percent of the volume produced was hardwoods of which almost two-thirds was oak. The principal components of the softwood production were white pine and hemlock, together comprising over two-thirds of the cut in this species group.

Table 8. - Lumber production by capacity class of sawmill and species group, 1940.

Rated capacity of mill per 8 hr. day	Softwoods	Hardwoods	All species	
	M bd.ft.	M bd.ft.	M bd.ft.	Percent
1 - 9	28,300	106,900	135,200	68.5
10 - 19	1,800	16,200	18,000	9.1
20 and over	7,600	36,700	44,300	22.4

Lumber production in 1940 was far from the total production capacity of the sawmills in the region inasmuch as the average mill operated only 51 days during the entire year. If all mills had operated full time (250 days) during 1940, total production--based on the average daily capacity of all mills--could have equaled 978 million board feet or 5 times as much as the actual amount cut. Hence, an increased demand for sawed products might easily result in a substantial increase over the saw timber drain of 1940.

Table 9. - Lumber cut and total saw timber stand by species groups and tree diameter classes, 1940.

Species groups and diameter classes (inches)	Lumber cut	Saw timber stand
	Percent	Percent
Hardwoods:		
10-12	3	-
14, 16, & 18	42	52
20 and over	55	48
Total	100	100
Softwoods:		
6-8	Negl.	-
10-12	13	40
14, 16, & 18	48	36
20 and over	39	24
Total	100	100

Studies made on the cutting areas revealed that the lumber industry was obtaining a substantial proportion of its material from the larger trees, as 87 percent of the softwood was cut from trees over 13.0 inches in diameter and 55 percent of the hardwood was from trees over 19.0 inches in diameter (table 9). The proportion cut from small trees was appreciably less than their occurrence in the saw timber stand, resulting insofar as the lumber industry is concerned, in an increase in the proportion of the small tree growing stock. In contrast to this, the proportion

cut from trees over 19.0 inches d.b.h., in both hardwood and softwood, was in excess of the proportion of saw timber volume in these larger trees. This is not necessarily a bad practice, but unless the volume recruited from smaller trees is sufficient to compensate for over-cutting there will be a gradual decrease in the quantity of large size growing stock.

Only a few of the mills owned lands from which their sawlogs were obtained; as a result, only 16 percent of the total production consisted of material harvested from company-owned lands (table 10). Only the larger mills obtained a significant proportion, 44 percent, of their saw timber from their own holdings. The smaller mills, as well as those of daily capacities of 10 to 19 thousand board feet, relied on purchased stumpage as their chief source of raw material. Even the larger mills obtained a substantial part of their saw timber from purchased stumpage. Altogether, 44 percent of the sawlogs were from this latter source. Custom and contract-sawed logs each comprised about the same proportion of the total production as logs obtained from company-owned lands. However, practically all of the custom sawing and most of that by contract was done by mills of 1 to 9 thousand board feet daily capacities. Logs purchased "delivered at the mill" formed only 8 percent of the total production and were important chiefly at those mills whose daily production ranged from 10 to 19 thousand board feet.

Table 10. - Source of logs for mills of various capacity classes, 1940.

Source of logs	Rated capacity of mill M bd. ft. per 8 hours			
	1 - 9	10 - 19	20 and over	All mills
	Percent	Percent	Percent	Percent
Mill owned land	8	4	44	16
Purchased stumpage	44	57	40	44
Purchased logs	2	31	16	8
Contract sawing	22	8	-	15
Custom sawing	24	Negl.	-	17
Total	100	100	100	100

Milling equipment: Besides being small, the typical mill of the mountain region was a simple affair equipped only with the bare essentials for sawing lumber (table 11). Sawing was done chiefly by means of a steam or gasoline-powered circular saw and the carriage operated by a belt or friction feed. Only about one-tenth of the mills had edgers and a still smaller number had planers. The best equipped operators were those sawing 20 thousand board feet or more per day. All of these were band mills and most of them had resawing and edging equipment, but only one-half had trimmers, and only one-third had planers and dry kilns.

Table 11. - Descriptive summary of sawmills by various capacity classes, 1940.

Item	Rated capacity M bd.ft. per 8 hours			All mills
	1 - 9	10 - 19	20+	
	Number	Number	Number	Number
Total sawmills:	982	11	6	999
Portable	637	2	-	639
Stationary	345	9	6	360
Operating power:				
Steam	549	9	6	564
Gasoline 1/	392	-	-	392
Water	22	-	-	22
Electric	11	2	-	13
Diesel	8	-	-	8
Carriage feed:				
Belt or friction	975	6	-	981
Auxiliary steam	7	4	1	12
Shotgun	-	1	5	6
Mill equipment:				
Circular saw	981 2/	10	-	991
Band saw	1	1	6	8
Resaw	-	1	1	2
Edger	118	10	4	132
Trimmer	6	1	3	10
Planer	41	2	2	45
Dry kiln	4	3	2	9

1/Old auto or truck motors used at 172 mills, tractors at 129, and industrial engines at only 91.
2/Includes 1 slash saw.

With the exception of those operated by waterpower, practically all mills of rated daily capacities of 1 to 9 thousand board feet were of a portable type. For various reasons about one-third of these mills remained stationary from year to year--most of them engaged in custom-sawing only. The remaining two-thirds of the small mills averaged about 3 sets during 1940--a few not changing location at all and other shifting as many as nine times. All but two of the 10-19 thousand board foot class of mills and all of those of larger daily capacities were operated as stationary units.

Transportation of logs: The sawmills of the mountain can be divided into two transportation groups: (1) those depending chiefly on their own equipment for transporting logs to the mill, and (2) those relying principally on outside means of transportation. Falling into the first group are mills which obtain most of their logs from purchased stumpage or from their own land; and in the second group are the mills engaged mainly in custom sawing or processing logs purchased "delivered at the mill."

In 1940, most of the mills (54 percent) in the first group depended upon animals, chiefly horses, for log transportation from the woods to the mill (table 12). For the most part, such operations ground-skidded their logs directly to the mills on short hauls (up to 1/4 mile) or bunched the logs and transported them by wagon on the longer hauls. Thirty-four percent of the mills employed a combination of animal and truck transportation. In such cases, the animals were used chiefly to bunch the logs in the woods and the trucks employed on the haul to the mill--the average

truck haul being about 2-1/4 miles. Only 2 percent of the mills used trucks as the sole means of transportation, the logs being hand-loaded directly on to the trucks. Tractors were used alone or in combination with other modes of transportation by about 10 percent of the mills. The tractors were principally employed on short hauls, skidding directly to the mill or bunching for truck haul. Only a few mills employed log transportation means other than animals, trucks, or tractors: 3 mills used gasoline skidders; 2 hauled by narrow gauge railroad; and 1 used a common carrier railroad.

Table 12. - Summary of transportation equipment used by mills obtaining stumpage chiefly by purchase or from own land, 1940.

Method of transporting logs to mill	Mills	Transportation Units			Volume Transported	
		Animals	Trucks	Tractors		
	No.	No.	No.	No.	M bd.ft.	Percent
Animals only	289	596	-	-	43,916	38
Animals and trucks	184	396	205	-	46,018	40
Trucks only	10	-	12	-	544	Negl.
Tractors only	20	-	-	19	7,773	7
Tractors and trucks	9	-	13	11	3,437	3
Tractors and animals	15	30	-	14	7,572	7
Tractors, animals & trucks	8	14	10	8	5,514	5
Total[1/]	535	1,036	240	52	114,774	100

1/Does not include 11 mills which produced 49,641 M bd. ft. in 1940. These mills did not report quantity of transportation equipment.

Of the operations that relied largely on outside transportation as a means of getting the logs to the mill, 441 did custom sawing only, 7 bought all their logs at the mill, and 5 did contract sawing. On the basis of 292 mills reporting, logs were transported as follows:

	Percent of mills	Percent of logs hauled
Animals only	43	40
Trucks only	8	6
Animals and trucks	48	54
Tractors only	1	Negl.
Total	100	100

Exact data on the quantity of logs transported by the various methods are not available. From the facts on hand, however, it is estimated that about 90 percent of the logs processed in 1940 were transported all or part of the way to the mills by means of animals. Truck hauling was involved in the movement of about 50 percent of the logs, and tractors assisted in the transportation of about 20 percent.

Other Primary Forest Industries

There were 33 plants in addition to sawmills using wood as a primary source of raw material in 1940 (fig. 13). The largest of these non-lumber producing plants were three pulp mills located at Bristol, Covington, and Buena Vista. Of the remaining plants, 9 processed wood or bark for

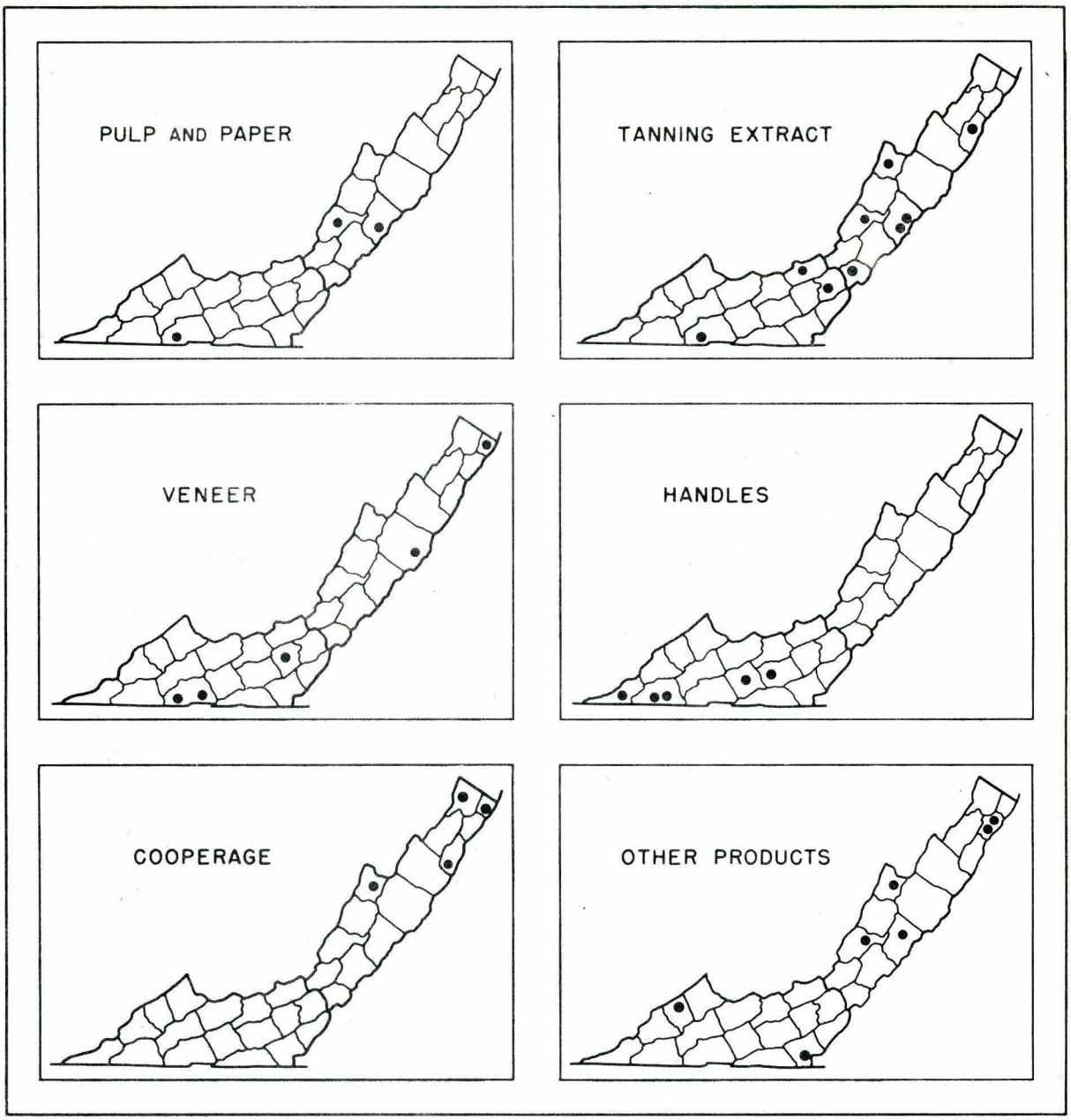

Figure 13. - Approximate location of primary non-lumber forest products plants, 1940.

tanning extract, 5 manufactured veneer, 5 produced handles or handle blanks, 4 made cooperage stock, 3 turned out insulator pins, and one each made shingles, boxes, mine wedges, and specialty products. In the aggregate, more wood was used in 1940 by the non-lumber plants and for fuelwood, fence posts, mine timbers, and hewn ties than was used by the sawmills. The equivalent of 1.7 million cords were consumed as compared with 0.6 million cords processed for lumber, timbers, and sawed ties.

Pulp and paper: In 1940, the mill located at Bristol made pulp only while the other two mills manufactured both pulp and paper. The industry as a whole used about 2-1/2 times as much wood as the aggregate amount consumed by the other 30 non-lumber plants in the region. Both softwoods and hardwoods were used by these mills; 73 percent of the wood used was yellow pine, 18 percent was yellowpoplar, and 9 percent consisted of miscellaneous hardwood species. Approximately three-fourths of the wood processed was transported to the mills by rail--some being hauled as far as 500 miles--and the remainder delivered by trucks. Only one-fourth of the wood came from the mountain region and the remainder was obtained from other sections of the state and adjoining states.

Tanning extract: All of Virginia's tanning extract production was from the 9 plants of the mountain region, 6 of which were located in Unit 4 and the remainder in Unit 5. In 1940, these plants were second only to the pulp mills in wood consumption, using about 106,000 cords. Nine-tenths of the raw material used was chestnut wood, and all of the remainder was chestnut oak bark. A very small amount, if any, of the chestnut oak was cut for bark only, and for the most part barking operations were associated with the harvesting of other products, such as ties and lumber. Slightly over one-half of the wood and bark consumed came from the mountain region. The remainder came from nearby territory within the state or in West Virginia. All of the material used was hauled to the mills by means of trucks.

Veneer: Two of the veneer plants were located in Washington County, and one each in Clarke, Augusta, and Pulaski Counties. The plant in Clarke County made vegetable baskets from yellowpoplar. All of the other plants manufacture furniture veneer, and, in addition, the one in Pulaski County made furniture. In 1940, the equivalent of 6.6 million board feet of veneer logs were processed by these mills. About 5.6 million board feet of the material consumed was of native tree species, 52 percent of which was yellowpoplar, 21 percent oak, 16 percent miscellaneous hardwood (principally black walnut, maple, and basswood), 9 percent redcedar, and 2 percent chestnut. Also processed were about 1.0 million board feet of foreign woods, chiefly mahogany. The forests of the mountain region supplied 31 percent of the native wood used in the veneer plants; 34 percent came from other sections of Virginia; and 35 percent was obtained from adjoining states, principally Tennessee. Trucks hauled 69 percent of the logs and railroads transported the remainder.

Handles: All of the handle mills were located in Unit 5. Two of the plants made handle blanks only, shipping these blanks to other mills for finishing. Approximately 8,900 cords of hardwood were consumed in 1940. Of the material used 86 percent was hickory, 9 percent oak, and 5 percent ash. Four-fifths of the supply came from the Virginia mountain region and most of the remainder was brought in from Tennessee. All material was transported by means of motor trucks.

Cooperage: Finished cooperage was not made in the mountain region. One mill in Highland County produced whisky barrel staves. Another plant in Frederick County turned out heading for apple barrels. The mill in Clarke County specialized in staves for poultry barrels, and the plant in Page County made staves for miscellaneous slack cooperage. Three-fourths of the material used was oak and most of the remainder was yellowpoplar. Of the 3,100 cords consumed in 1940, 57 percent came from the mountain region and the remainder from adjacent areas in the state or West Virginia. Practically all of the wood was brought in by trucks.

Insulator pins: All of the small plants making insulator pins were located in the northern part of the mountain region. In 1940, about 1,500 cords of locust and 50 cords of oak were consumed by these plants. All of this material was hauled by truck--about one-half of it coming from the mountain region and the balance from nearby areas in Virginia, West Virginia, and Maryland.

Miscellaneous plants: One small plant in Carroll County made boxes from yellowpoplar for use by local apple orchards. Another plant in Dickenson County used miscellaneous hardwoods to make 12" x 6" x 1" wedges used in nearby coal mines. A shingle mill, associated with a small sawmill, in Rockbridge County made shingles from white pine. A plant in Warren County specialized in turnery products such as mauls and mallets made from dogwood and hickory. In the aggregate the 1940 consumption by these 4 mills was small, as only about 900 cords of wood were processed. Over four-fifths of the material was obtained from the mountain region, and, for the most part, was delivered to the plants by means of trucks or teams.

Fuelwood: In 1940, more wood was used for fuel than for any other single purpose. During that year, over 1.0 million cords of wood, representing 47 percent of the total consumed for all products, were used as fuel. Eighty-six percent of the fuelwood consisted of hardwood, chiefly (57 percent) oak. By far the greatest proportion of the wood used was derived, as it should be, from material that might not otherwise be utilized--64 percent from dead and cull trees and the tops and limbs of sound trees, and 20 percent from mill waste. Sound live trees cut specifically for fuel comprised only 16 percent of the total.

As a group, farmers were the greatest consumers of fuelwood, using in 1940 a total of 650,000 cords or about 8.7 cords per family. Rural nonfarm residents consumed 280,000 cords, or 5.1 cords per family. Residents

of small towns used 23,000 cords and city residents 25,000 cords averaging 1.7 and 0.5 cords, respectively, per family. In addition to the fuelwood produced for domestic use, approximately 63,000 cords were cut for industrial purposes such as brick and lime kilns, canneries, and poultry brooders.

Other products: About 104,600 cords of wood went into the making of about 5.1 million mine props for the coal mines of southwestern Virginia, eastern Kentucky, and West Virginia. Only 10 percent of the material that went into mine timbers was softwood, chiefly shortleaf and Virginia pine. Of the hardwoods used 37 percent was oak, 15 percent gums and yellowpoplar, and 48 percent other hardwoods.

The farmers of the region cut about 30 million fence posts (about 47 posts per farm), requiring approximately 36,000 cords of wood. Black locust was preferred as four-fifths of the material used was of this species. Dead chestnut and redcedar were the other principal species used for posts.

A total of 54,000 hewn ties were produced in 1940. All of these were made of oak requiring about 8,500 cords of this species for the year's production.

Employment

In 1940, the primary wood-using industries of the mountain region provided about 3.9 million man-days of 8 hours--the equivalent of 15,552 man-years of 250 days each--of woods and plant employment. About 45 percent of the total employment was in connection with the harvesting and processing of the products produced by the 33 non-lumber plants; 37 percent was utilized in cutting fuelwood, mine props, and fence posts and in hewing crossties; and 18 percent was provided by the lumber industry.

The various phases of woods activity required by the primary industries provided 2.6 million man-days of work. Depending upon the product harvested, the woods employment was expended in felling, bucking, splitting, peeling, and transporting the material to the mill or market. Fuelwood and fence posts were largely prepared for domestic use, hence very little cash income was obtained from the 1.3 million man-days spent in harvesting these products. Such cash income as was derived from woods work came from an additional 1.3 million man-days required to cut and haul sawlogs, pulpwood, extract wood, crossties and various kinds of bolts. Assuming 35 cents as the average hourly rate for woods labor, approximately 3.6 million dollars were earned in 1940.

About 7,800 men were provided with approximately 1.3 million man-days of work in the various forest products plants. Much of this employment was only part-time as the 4,395 workers employed in sawmills averaged only 86 man-days of work during the year. But the 149 workers engaged in making handles, cooperage, insulator pins, and other minor products averaged about 208 man-days of employment, and in the pulp and paper, tanning extract, and veneer plants, the 3,275 workers were employed an average of 285 man-days. At an estimated rate of 40 cents per hour, the mill workers received about 4.2 million dollars in 1940.

COMMODITY DRAIN

In 1940, the total amount of wood cut from the sound tree growing stock--including the wasted as well as the utilized portions of the felled trees--was 211.5 million board feet of saw timber or 923.7 thousand cords[1/] of all sound material (tables A-18 and A-19).

Saw Timber Drain

Eighty percent of the commodity drain from saw timber was cut for the production of lumber, timber, and sawed ties; 8 percent was for pulpwood; 4 percent for fuelwood; and 3 percent for mine props. Only 5 percent was cut for veneer, cooperage, fence posts, hewn ties, and other minor uses (table 13). About 161.0 million board feet of the sawlog drain were of hardwood--66 percent oaks, 14 percent gums and yellowpoplar, and the balance of miscellaneous species. Softwood drain equaled 50.5 million feet, approximately 47 percent yellow pine, and 53 percent of other species. Seventy percent of the saw timber drain in softwoods was from trees 14 inches d.b.h. and larger and 51 percent of that in hardwoods was from trees 20 inches and over.

Table 13. - Commodity drain from sound tree growing stock, 1940.

Commodity	Saw timber		All sound trees	
	Softwoods	Hardwoods	Softwoods	Hardwoods
	M bd. ft.	M bd. ft.	Cords	Cords
Lumber	35,300	133,500	95,800	389,900
Pulpwood	10,300	6,500	59,600	50,300
Fuelwood	2,600	6,400	24,700	141,100
Mine props	1,500	5,600	10,000	90,800
Hewn ties	-	2,400	-	9,200
Veneer	100	2,100	200	5,500
Cooperage	-	1,400	-	4,000
Fence posts	300	500	1,800	28,500
Miscellaneous	400	2,600	1,900	10,400
All commodities	50,500	161,000	194,000	729,700

1/Drain expressed in cords, in addition to sawlog portions of trees cut, includes the usable volumes in the upper stems of softwood saw timber as well as that in felled trees of all species 5.0 inches d.b.h. to saw timber size.

Cordwood Drain

Of the drain of all sound material 486,000 cords, 53 percent, were taken in the form of sawlogs for the production of lumber, timber, and ties. Next in importance was fuelwood which amounted to 166,000 cords, or 18 percent of the total commodity drain. About 110,000 cords were cut as pulpwood, 101,000 cords were harvested as mine props, and the remainder, 61,000 cords, went for other uses, principally fence posts, ties, veneer, and cooperage. Approximately 62 percent of the total drain was from the southern part of the region which reflects, at least in part, a greater concentration of forest industries in that area than elsewhere in the region.

Seventy-nine percent of the total drain for all commodities consisted of hardwood, 60 percent of which was oak, 15 percent gums and yellow-poplar, and 25 percent other hardwoods. The yellow pines comprised almost two-thirds of the softwood drain while the remainder consisted of miscellaneous species.

An analysis of total commodity drain by diameter classes in cubic feet (table A-20) within major species groups gave the following results:

	All Species Percent	Softwoods Percent	Hardwoods Percent
6 and 8 inch trees	17	22	16
10 and 12 inch trees	24	28	22
14, 16, and 18 inch trees	32	32	32
20 inch trees and larger	27	18	30
Total	100	100	100

It is obvious from the above tabulation that a fairly heavy drain exists in smaller diameter trees. In addition to the fuelwood requirements within the area, available markets for pulpwood and mine props of both hardwood and softwood species contribute heavily to this situation.

FUTURE TIMBER SUPPLY

By means of data collected by the Forest Survey in 1940, it is possible--with certain assumptions--to estimate what the timber supply may be at a given time in the future. The assumptions which must hold in such a forecast are: (1) that commodity drain is maintained at the 1940 level and is of the same proportionate distribution by diameter classes and species, (2) that the volume of growth recruiting into the 6 and 8 inch diameter class is the same as in 1940, (3) that the ratio of inventory to growth recruiting out of any diameter class is comparable to that of 1940, and (4) that the growth rate of trees in any diameter class is similar to 1940.

Nineteen-forty was selected as a base period for future stand predictions because detailed information on the timber was available for that year. This does not imply that forest practices or other conditions were especially desirable at that time. Actually the results would be more favorable if a lighter cut and more intensive forest practice were assumed to be in effect.

This prediction indicates what might happen under a continuation of conditions existing in 1940. If the past is any indication of what may take place in the future, variations are certain to occur in commodity drain, the growth rates of individual trees and stands, mortality, cutting practices, and stand composition--all factors which affect the growth and development of the forest. Hence, this or any forecast should be interpreted with caution and with full appreciation that there may be a considerable difference between the actual and estimated future timber supply. Another point to keep in mind is that the prediction is made for the mountain region as a whole, and that the estimate made cannot be applied to smaller areas where conditions are likely to vary considerably from the average. For example, in areas near the coal mines, the heavy drain of material for mine timbers will probably prevent any increase in growing stock. Conversely, in the national forests, cutting is regulated with the specific objective of building up the growing stock as much as possible. Obviously, estimates made for the entire mountain region would not hold for areas such as these.

The Total Supply

In 1940, the surplus of growth over drain amounted to 28.8 million cubic feet, resulting in an increase of 0.5 percent in the saw timber growing stock and 1.5 percent in the volume of sound trees 5 inches and over d.b.h. (table A-21). Overcutting occurred only in the larger diameter classes (table A-22). Drain exceeded growth in the 20 inch and larger hardwoods to the extent of 0.5 million cubic feet and in the 14 inch and larger softwoods by about 1.3 million cubic feet.

By following through with a forecast based on the aforementioned assumptions, the indicated gains in the total growing stock take on considerable significance. At the end of 30 years the total growing stock would amount to about 4.1 billion cubic feet as compared with 1.9 billion cubic feet in 1940. Furthermore, rather substantial gains in volume, chiefly recruited from smaller trees, would take place in all but the 20 inch and larger diameter class. In proportion to the present growing stock, the indicated gain in volume of 6 and 8 inch trees would be about 145 percent; 10 to 20 inch trees would increase by about 170 percent; 20 inches and over, the gain would be slight, amounting to only 2 percent.[1/] It should be kept in mind, however, that this estimate includes growth on inferior and non-commercial species and on trees which for various reasons may never be cut. Thus, the net gain in the usable volume of the total

1/Gain in 20 inch and larger class results from large volume recruited from smaller diameters over 30 year period.

growing stock may be substantially less than the figures indicate. This is borne out somewhat in the following analysis by species group.

The Supply of Softwood

In the softwoods 5 inches and larger d.b.h., growth exceeded drain by about 5.8 million cubic feet (table A-21). As a result of this surplus, the saw timber growing stock increased approximately 0.6 percent and the total stand gained about 1.4 percent in volume. Virginia pine, which formed only 19 percent of the total softwood growing stock, contributed 77 percent of the increase in volume. In contrast to this, shortleaf pine[1] produced only 15 percent of the gain in softwoods and, yet, was the chief component (45 percent) of the growing stock. Similarly, other softwoods[2], forming the balance of the softwood stand, or 36 percent, comprised only 8 percent of the increase.

Under growth and drain relationships similar to 1940, the Virginia pine growing stock will continue to increase at a more rapid rate than the remainder of the softwoods. At the end of a 30-year period, the total stand of softwoods 5 inches and larger in diameter will amount to about 987 million cubic feet. Of this amount 47 percent will consist of Virginia pine, 31 percent other softwoods, and 22 percent shortleaf pine. The volume of Virginia pine would be approximately five times greater in 1970 than in 1940, other softwoods would practically double in volume, and shortleaf pine would just about hold its own (fig. 14).

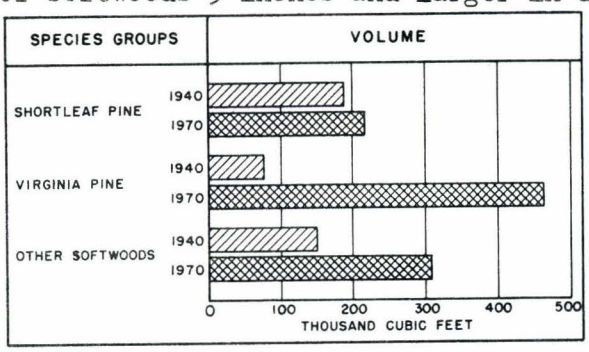

Figure 14. - Possible changes in the softwood growing stock by species groups if drain is maintained at the 1940 level for 30 years.

No great increase can be expected in the softwood species most in demand unless more of the Virginia pine and less of the preferred species are cut--a situation that might easily be attained if more of the pulpwood requirements were met with Virginia pine. In 1940, the shortleaf pine in the 6 and 8 inch diameter class was overcut by about 11,700 cords and in the 10 and 12 inch class increased only 11,800 cords, resulting in a negligible gain (table A-23). In contrast to this, the 6 and 8 inch and 10 and 12 inch diameter classes of Virginia pine increased 32,700 and 27,400 cords, respectively. Obviously, more Virginia pine could be cut in lieu of the shortleaf.

Some overcutting also took place among the other softwoods. In this group of species, 1940 drain exceeded growth by about 27,200 cords in trees 14 inches and larger d.b.h. In 30 years, the growth recruited from trees of smaller diameters should overcome the volume losses in 14, 16, and 18

1/Shortleaf, pitch, and table mountain pines.
2/White pine, hemlock, red spruce, and redcedar.

inch trees. In fact, a moderate increase of about 67 percent in volume could be expected. But, in the case of trees 20 inches and over in diameter, a maintained rate of cutting similar to 1940 would, for all practical purposes, result in their early elimination from the growing stock (table A-24). Consequently, a reduction in the quality of the stand of other softwoods is inevitable, unless drain within the species groups is reduced.

The Supply of Hardwood

In 1940, growth exceeded drain in the hardwoods by about 23.0 million cubic feet (table A-21). As a result, the saw timber stand increased in volume by about 1.6 percent, and the total hardwood growing stock gained approximately 0.5 percent. Only 9 percent of the total increase was gum and yellowpoplar,[1/] a gain directly proportionate to the quantity of these species in the total hardwood stand. The oaks,[2/] which formed 63 percent of the growing stock, comprised only 34 percent of the volume increase; and the other hardwoods[3/] which constituted 27 percent of the growing stock produced most, 57 percent, of the growth.

Overcutting occurred in the 10 and 12 inch diameter class of the gum and yellowpoplar group and in the 20 inch and larger oaks. In the case of the 10 and 12 inch trees, however, the surplus growth in the other species group (oaks and other hardwoods) was sufficient to cause a net increase of 34,800 cords within the diameter class (table A-23). But, even though there was some gain in the volume of gum and yellowpoplar and other hardwoods in the 20 inch and over diameter class, they were inadequate to offset the deficit in the large oaks; thus, the diameter class suffered a loss of about 6,900 cords.

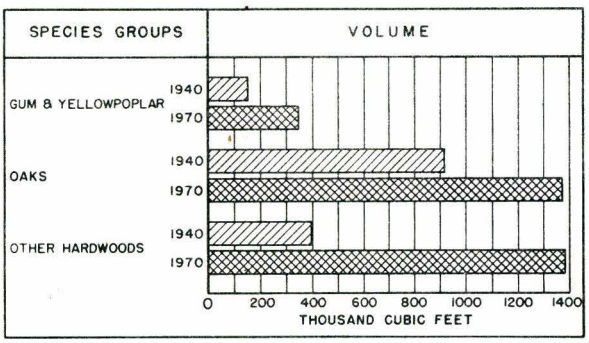

Figure 15. - Possible changes in the hardwood growing stock by species groups if drain is maintained at the 1940 level for 30 years.

Under conditions of growth and drain maintained at the 1940 level, the outlook as to a future supply of hardwood appears to be a promising one--at least from the standpoint of an increase in the total volume of growing stock if not from that of stand composition and quality. In 30 years, the total hardwood growing stock may amount to about 3.1 billion cubic feet, or twice its present volume. Of the three major species groups comprising the hardwoods, the other hardwoods--with an increase amounting to about 3-1/2 times its present volume--will benefit the most; the gum and yellowpoplar group will slightly more than double in volume; and the oaks will increase by about one-half (fig. 15). It is estimated, however, that the gum

1/Black gum and yellowpoplar.
2/Oak only.
3/All other hardwoods found in Mountain Region.

and yellowpoplar group will just about maintain its 1940 status in relation to the total stand of hardwood, the proportion of oak will be less, and that of other hardwoods will be greater.[1/]

An increase in the proportion of other hardwoods might appear desirable. But, in reality, about one-half of the volume in this group in 1940 was comprised largely of low value species such as red maple, black and river birches, pignut hickory, and scrub hardwoods.[2/] The presence of these and other low value species in relatively large volume is at least partly due to the overcutting of the more valuable kinds of trees. Although more and more of the poorer species are being utilized, indications are the trees of higher value will continue to be cut excessively. Thus, it appears reasonable to assume that a greater part of the 1970 stand of other hardwoods will consist, as in 1940, of the less important species. Similar conclusions may be drawn for the oak and the gum and yellowpoplar groups as both contain a large proportion of low grade species, namely, black gum in the gum and yellowpoplar group, and chestnut, black, pin, scarlet, and post oaks in the oak group.

Over a 30-year period, growth-drain relationships similar to 1940 would have but a small effect, except in the oaks, on the proportionate distribution of volume by diameter classes. In the oak group most of the volume increase would occur in 6 and 8 inch, and 10 and 12 inch diameter classes, each about doubling their 1940 volumes (table A-24). A slight gain of about 5 percent would be realized in the volume of 14, 16, and 18 inch trees. But in the case of trees 20 inches and larger the volume in 1970 would be about 40 percent less than that occurring in 1940. Each diameter class in the gum and yellowpoplar group would increase to about twice its 1940 volume and in the other hardwoods group about 3-1/2 times. The bulk of the growing stock

Table 14. - Probable distribution of the growing stock by tree diameter classes within hardwood species groups if drain is maintained at the 1940 level for 30 years.

Diameter class	Species groups							
	Oak		Gum, yellowpoplar		Other hdwds.		All groups	
	1940	1970	1940	1970	1940	1970	1940	1970
Inches	Percent of total growing stock							
6-8	22	32	20	19	28	31	24	30
10-12	28	40	28	26	33	31	30	34
14-16-18	26	18	32	34	33	32	28	26
20 and over	24	10	20	21	6	6	18	10
Total	100	100	100	100	100	100	100	100

1/Based on cubic volume contained in trees 5 inches and larger d.b.h., the 1940 stand of hardwood consisted of 10 percent gum and yellowpoplar, 63 percent oak, and 27 percent other hardwood as compared to 11 percent gum and yellowpoplar, 44 percent oak, 45 percent other hardwoods estimated for 1970.

2/Fire cherry, sassafras, ironwood, scrub oak, etc.

volume will be in small trees, even as in 1940, for all species groups—the gums and yellowpoplar and the other hardwoods holding to about the same proportion as in 1940 and the oaks having a much larger proportion of volume in small trees (table 14).

Effect of War Demands

The current demand for wood as a war material dates from the summer of 1940 when the Army began to buy lumber for training camps. On the basis of Forest Service estimates for the state as a whole, it is indicated that the output of lumber in 1941 was about 20 percent more than in 1940, and in 1942 production was about 15 percent greater. It is believed, however, that war demands reached their peak in 1942. In that year national lumber consumption was 30 percent greater than in 1940. Lumber requirements for 1943 and 1944 are estimated to be 11 and 18 percent, respectively, less than 1942 consumption, indicating a downward trend.

Although the total demand appears to be diminishing, war needs are now drawing more heavily on the better species of high quality for special uses, such as ship timbers, aircraft veneer and lumber, and truck bodies. Most shipyards specify that keel stock be free from heart center and sap. Thus, white oak trees of unusually large diameter and clear length are necessary to permit keel stocks to be cut from the logs as side cuts. In general, a tree diameter of 20 inches is considered necessary for the production of ship timbers. The greater part of the yellowpoplar aircraft lumber and veneer is manufactured from No. 1 and select logs. Most of these logs can be obtained only from straight, sound trees above 20 inches in diameter. The specifications for truck body material are not as rigid as those for ship timbers and aircraft material, yet are sufficiently high to encourage the cutting of better quality trees. Even in 1940, the large oaks were being overcut, and the surplus of growth over drain of the yellowpoplar group and other hardwoods was insufficient to offset the deficit in the large oaks. Obviously war drain will bring about a still greater deficit in the volume of the large, high quality, growing stock.

In view of the above discussion it appears logical to conclude that war drain on the forest resource of the mountain region is more likely to cause a loss in quality of the stand than to decrease the total volume. Thus, the proportion of inferior species and cull trees, which even in 1940 was much too high, will increase at the expense of the better quality trees, creating future complex problems of utilization and management.

CONCLUSIONS

Because the present forest is confined chiefly to areas of poor soil and rough topography, it is quite unlikely that any significant portion will give way to other uses. It is more likely that the area of forest cover will increase in the future as submarginal land now in crop or pasture is abandoned. As over one-half of all the land is now in some sort of forest cover, serious consideration must be given to its future management in order that it may make its proportionate contribution to the economic welfare of the region.

In comparison with the original forest the present yield from the woodland is small. This is primarily due to a disproportionately large acreage stocked with small trees, an excessive quantity of cull volume, a small amount of growing stock per acre, and an overabundance of inferior species. Increasing the yield is largely a matter of time plus continued and adequate fire protection, and more judicious cutting practices. Approximately three-fourths of the forest land bears stands that must grow from a few years to many decades before attaining saw timber size. In these areas adequate fire protection is essential to stand development, and in addition various degrees of improvement cuttings are desirable in order that a higher proportion of well formed trees of desirable species will be realized in the final stand. Adequate fire protection is also necessary in the existing saw timber areas, to preserve what high value timber remains and to insure the development of succeeding stands of good quality. Furthermore, better utilization practices are needed within the areas bearing timber of sawlog size. Cull and poorly formed trees and less valuable species such as the chestnut, pin, scarlet, southern red and post oaks, red maple pignut hickory, and black gum should be cut in greater proportion than they now are--leaving more of the white and nothern red oaks, yellowpoplar, and shagbark hickory to form the nucleus of a better stand.

An increase in the total volume of growing stock depends upon the maintenance of an annual commodity drain below yearly net increment. There appears to be a fairly good chance of attaining such a goal in the mountain region. In 1940--a year of good demand--there was a favorable growth-drain relationship. Heavier cutting occurred in 1941 and 1942, and drain may have exceeded growth in those years. But, the trend is toward a drain about the same as in 1940, and unless some unforeseen emergency or demand develops it is expected that the drain will be around that level for some years to come. By the maintenance of drain at the 1940 level it may be possible in about 30 years to double the volume of the total growing stock. It should be noted, however, a large part of the volume increase will be in trees less than saw timber size and of low commercial value. Even though the quantity of saw timber were doubled, the stand would average only a shade over 2,000 board feet per acre--or about two-fifths the estimated volume of the original stand--and contain as great, if not a larger, proportion of inferior trees than now exist. The forest growing stock would develop faster if the cut were reduced below that of 1940 for the next decade or so, but this must be governed by the immediate needs of the nation and local industries and people.

An improvement of the quality of the growing stock is possible without a reduction in the annual cut. A considerable quantity of cull hardwood could be converted to fuelwood if woodcutters would confine their harvesting to trees of this type. The development of some new plants using hardwood species in short lengths and small diameters would provide a market for low grade wood now considered as cull material. Particularly adapted to the utilization of the abundant low grade oak would be small plants manufacturing laminated flooring following a process devised by the Tennessee Valley Authority and cooperating agencies. The feasibility of constructing one or more wood distillation plants should also be investigated. Such plants would find an ample supply of sound hardwoods, which for reasons of form are not suited for manufacture into lumber. Recent rapid advances in the manufacturing technique and in the use of wood plastics suggests the possibility of utilizing a large volume of low value species through the establishment of a plastics industry in the region.

It is improbable that private initiative alone will develop and carry out the constructive measures necessary to the development of a greater and more valuable forest resource capable of making a continued and significant contribution to the welfare of the mountain people. The program presented by the Forest Service to the Joint Congressional Committee on Forestry established by the Seventy-fifth Congress (S. Con. Res. 31) contains measures designed to correct a forest situation such as exists in this region. Measures most applicable to this region are: (1) intensification of cooperative protection against fire, insects, and disease on private and state owned forest land; (2) more adequate protection against fire, insects, and diseases on national forests; (3) improvement and expansion of forestry extension programs, including one involving education in wood utilization; (4) encouragement and development of farm forest cooperatives, including financial aid in building and operating forest industries; (5) intensification of forest products and forest management research; (6) extension of state forest ownership; and (7) public control of cutting practices on private land involving silvicultural measures needed to keep the forest land reasonably productive, so as to insure watershed protection, help safeguard local communities, furnish necessary supplies of timber for local and national use, including national defense.

APPENDIX

Definition of Terms

General

Forest Survey Unit: The term "forest survey unit" denotes an area of 4 to 10 million acres in which topographic, forest, and economic conditions are reasonably homogenous.

Land-use Class

Commercial forest: Forest land having qualities essential to the production of commercial timber.

Public reserved forest: Forest land in federal and state ownership upon which commercial timber cutting is prohibited.

Agriculture: Non-forest land used for production of farm crops within the last five years.

Abandoned cropland: Land once cultivated, now evidently abandoned for farm crops, but not bearing forest cover.

Pasture: Cleared, fenced lands that are used primarily for grazing.

Other non-forest: Includes areas within the corporate limits and suburban or industrial sections of towns and cities; power, rail, and highway rights-of-way; water areas, and miscellaneous non-forest.

Forest Type

Mountain hardwoods: Stands predominately of mixed oak which with other hardwoods make up 75 percent or more of the dominant and codominant trees; usually found on the mountain slopes and ridges.

Cove hardwoods: Stands in which yellowpoplar and other hardwoods make up 75 percent of the dominant and codominant trees; usually found on lower mountain slopes and the coves of small streams.

Shortleaf-pitch pine: Stands in which pines make up 25 percent or more of the dominant and codominant trees with shortleaf or pitch and table mountain pine predominating. Shortleaf pine stands are usually found in the valleys and the pitch and table mountain pines on dry south and west slopes.

Virginia pine: Stands in which pines make up 25 percent or more of the dominant and codominant trees with Virginia pine predominating; usually found on poor soils at elevations below 3,000 feet.

White pine: Stands in which pines make up 25 percent or more of the dominant and codominant trees with white pine predominating. Includes stands of hemlock, red spruce and Fraser fir.

Diameter

D.b.h. (diameter at breast height): Diameter in inches, outside bark, measured at 4½ feet from the ground.

Diameter class: All trees were tallied by 2-inch diameter classes, each class including diameters 1.0 inch below and 0.9 inch above the stated midpoint.

Forest Condition

Saw timber stands: Stands containing sufficient volume in merchantable species to make at least 600 board feet per acre in the pine types and 1,000 board feet per acre in the hardwood types.

Cordwood stands: Stands of second growth in which the total saw timber volume is less than the required minimum for sawlog stands.

Reproduction: Stands of young second growth with little or no volume in trees over 1 inch in diameter, but bearing at least 80 well distributed seedlings per acre.

Clear-cut: Cut-over areas bearing insufficient young growth to qualify as reproduction.

Tree Classification

Sound saw timber tree: A softwood tree at least 9.0 inches d.b.h., and a hardwood tree at least 13.0 inches d.b.h. with not less than one sound butt log 12 feet long, or with 50 percent of the gross volume of the tree in sound saw timber.

Sound cordwood tree: Any sound, straight-boled tree between 1.0 inch d.b.h. and sawlog size.

Cull tree: Any tree that fails to qualify as a sound tree because of poor form, excessive limbiness, rot, or other defect.

Volume

Board-foot volume: The volume in board feet, exclusive of defect, of that portion of sound sawlog-size trees between the stump and the upper limit of merchantability for sawlogs, measured by the International ¼-inch rule.

Cordwood volume: The volume in standard cords of the sound portion of trees 5.0 inches d.b.h. and larger between stump and a minimum diameter of approximately 4.0 inches outside bark.

Cubic-foot volume: The solid cubic volume, excluding bark, of all material included in the cordwood estimate.

Growth

Growing stock: The sum of the volumes of all sound trees 5.0 inches d.b.h. and larger; dead and cull trees and tops of hardwood not included.

Board-foot growth: Includes the net growth on the saw timber portion of sawlog-size trees, plus the volume in sound trees reaching sawlog size.

Cordwood growth: Includes the net growth on the sound stemwood of softwoods 5.0 inches d.b.h. and over, on under-sawlog-size hardwoods, and on the sawlog portion of sawlog-size hardwoods, plus the sound tree volume of all species reaching 5.0 inches d.b.h. during the increment period.

Cubic-foot growth: Omits bark volumes, otherwise material is identical with cordwood.

Mortality

Mortality: The volume lost from the growing stock of the forest through the death of individual trees. Natural causes of mortality include lightning, tree competition, old age, disease, insects, drought, and wind. Fire is the major man-caused source of mortality.

Utilization:

Production: The volume of wood manufactured or consumed within the designated area, and expressed in units of measure characteristic of the industry.

Commodity drain: The volume of wood cut in the designated area from sound living trees, adjusted for such cutting practices as may over-cut or under-cut the basic volume tables, and excluding the cordwood volume cut from tops of hardwoods.

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Table A-1. - Total land area by type of use, 1940.

Type of use	Area in acres			Percent of total land area		
	Entire Region	Northern Unit	Southern Unit	Entire Region	Northern Unit	Southern Unit
Forest:						
Commercial	4,664,900	2,272,700	2,392,200	51.2	52.8	49.8
Reserved public	107,000	105,100	1,900	1.2	2.4	Negl.
Non-commercial	184,400	171,200	13,200	2.0	4.0	0.3
Total forest	4,956,300	2,549,000	2,407,300	54.4	59.2	50.1
Non-forest:						
Agriculture:						
Old cropland	1,622,700	801,700	821,000	17.8	18.6	17.1
New cropland	26,300	4,900	21,400	0.3	0.1	0.5
Pasture	2,209,100	800,100	1,409,000	24.2	18.6	29.3
Total agriculture	3,858,100	1,606,700	2,251,400	42.3	37.3	46.9
Abandoned cropland	77,600	34,700	42,900	0.9	0.8	0.9
Other non-forest[1/]	214,000	114,900	99,100	2.4	2.7	2.1
Total non-forest	4,149,700	1,756,300	2,393,400	45.6	40.8	49.9
All uses	9,106,000	4,305,300	4,800,700	100.0	100.0	100.0

1/Water, towns, rights-of-way, and farm home sites.

Table A-2. - Species composition of the forest types expressed in percent of net cubic volume, 1940.[1]

Tree species	Forest type					All types
	Shortleaf pitch pine	Virginia pine	White pine	Mountain hardwoods	Cove hardwoods	
Softwoods:						
Shortleaf pine[2]	69.8	6.9	2.2	3.2	0.1	8.4
Virginia pine	3.2	55.0	0.8	0.9	0.2	3.6
White pine	2.5	4.0	29.6	1.4	0.7	3.8
Hemlock	0.3	0.1	25.6	0.4	1.5	2.5
Red spruce	-	-	0.2	Negl.	0.1	Negl.
Redcedar	Negl.	0.6	0.2	0.4	0.2	0.4
All softwoods	75.8	66.6	58.6	6.3	2.8	18.7
Hardwoods:						
Northern red oak	0.6	0.9	3.1	8.7	12.2	7.6
Other red oaks[3]	7.4	10.5	6.9	18.2	2.4	14.0
Other white oaks[4]	0.1	0.5	Negl.	0.3	-	0.2
Chestnut oak	7.8	4.7	5.0	22.7	3.8	16.7
White oak	4.0	10.0	7.8	15.3	4.2	12.1
Yellowpoplar	1.2	1.5	2.9	4.7	23.1	6.6
Basswood	0.1	-	1.5	0.7	7.7	1.6
Red maple	0.1	0.3	1.9	2.0	3.8	2.0
Black gum	0.2	0.2	0.4	2.4	1.4	1.8
Birch[5]	Negl.	Negl.	1.7	0.6	4.4	1.1
Hickory	0.7	2.0	2.0	8.5	5.1	6.6
Ash	0.1	0.2	0.3	0.6	2.2	0.7
Sugar maple	-	Negl.	2.0	1.0	6.6	1.7
Cherry-walnut	Negl.	0.1	0.1	1.1	2.3	1.0
Black locust	0.7	1.2	0.8	3.2	3.0	2.7
Dogwood	Negl.	0.2	Negl.	0.1	0.2	0.1
Scrub hardwoods[6]	0.8	0.4	0.8	1.2	1.5	1.1
Other hardwoods	0.4	0.7	4.2	2.4	13.3	3.7
All hardwoods	24.2	33.4	41.4	93.7	97.2	81.3
All species	100.0	100.0	100.0	100.0	100.0	100.0

1/Average of all stands sampled in the Mountain Region.
2/Shortleaf, pitch, and table mountain pines.
3/Black, pin, scarlet, and southern red oaks.
4/Post oak.
5/Black, yellow, and river birches.
6/Scrub oak, fire cherry, ironwood, sassafras, etc.

Table A-3. - Forest area by forest type and forest condition, 1940.

ENTIRE REGION

Forest type	Saw timber stands: Old growth	Saw timber stands: Second growth	Cordwood stands	Reproduction stand1/	All conditions	
	Acres	Acres	Acres	Acres	Acres	Percent
Shortleaf-pitch pine	1,600	226,700	291,600	8,900	528,800	11.3
Virginia pine	800	70,700	174,500	39,100	285,100	6.1
White pine	5,700	133,000	59,800	1,600	200,100	4.3
Mountain hardwoods	99,500	1,199,800	1,841,700	75,200	3,216,200	69.0
Cove hardwoods	32,000	197,200	201,400	4,100	434,700	9.3
All types	139,600	1,827,400	2,569,000	128,900	4,664,900	
	Percent	Percent	Percent	Percent		
	3.0	39.2	55.1	2.7		100.0

NORTHERN UNIT

	Acres	Acres	Acres	Acres	Acres	Percent
Shortleaf-pitch pine	800	114,700	201,800	2,400	319,700	14.1
Virginia pine	800	50,900	122,700	27,500	201,900	8.9
White pine	800	64,600	15,300	1,600	82,300	3.6
Mountain hardwoods	50,100	532,000	936,600	25,000	1,543,700	67.9
Cove hardwoods	9,700	57,200	58,200	-	125,100	5.5
All types	62,200	819,400	1,334,600	56,509	2,272,700	
	Percent	Percent	Percent	Percent		
	2.7	36.1	58.7	2.5		100.0

SOUTHERN UNIT

	Acres	Acres	Acres	Acres	Acres	Percent
Shortleaf-pitch pine	800	112,000	89,800	6,500	209,100	8.8
Virginia pine	-	19,800	51,800	11,600	83,200	3.5
White pine	4,900	68,400	44,500	-	117,800	4.9
Mountain hardwoods	49,400	667,800	905,100	50,200	1,672,500	69.9
Cove hardwoods	22,300	140,000	143,200	4,100	309,600	12.9
All types	77,400	1,008,000	1,234,400	72,400	2,392,200	
	Percent	Percent	Percent	Percent		
	3.2	42.2	51.6	3.0		100.0

1/Includes 9,000 acres of clear-cut area.

Table A-4. - Net board foot volume in entire region by species and three log rules, 1940.

Species	International 1/4-inch rule	Scribner rule	Doyle rule
	M bd. ft.	M bd. ft.	M bd. ft.
Softwoods:			
Shortleaf pine	509,600	427,900	275,900
Virginia pine	130,600	104,700	58,900
White pine	328,300	286,600	210,300
Hemlock-spruce	240,000	216,300	176,800
Redcedar	11,400	9,300	5,400
All softwoods	1,219,900	1,044,800	727,300
Hardwoods:			
Northern red oak	474,200	434,700	363,600
Other red oaks	542,000	490,300	383,200
White oak	696,300	638,600	535,000
Chestnut oak	804,700	735,300	605,500
Other white oaks	7,400	6,600	5,300
Yellowpoplar	348,000	316,500	254,600
Basswood	68,100	61,800	48,800
Red maple	62,500	56,800	45,300
Black gum	120,600	109,200	85,700
Birch	37,300	33,700	26,500
Hickory	236,100	213,800	168,300
Ash	29,700	26,900	21,300
Sugar maple	96,500	88,900	75,800
Cherry-walnut	50,200	45,400	35,800
Other hardwoods	182,300	165,600	131,800
All hardwoods	3,755,900	3,424,100	2,786,500
All live species	4,975,800	4,468,900	3,513,800
Dead chestnut	758,400	693,800	574,600
All species	5,734,200	5,162,700	4,088,400

Table A-5. - Average board foot volume per acre, International 1/4-inch rule, by forest type and forest condition, 1940.1/

ENTIRE REGION

Forest type	Saw timber stands			Cordwood and reproduction stands	All conditions
	Old growth	Second growth	Average		
	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.
Shortleaf-pitch pine	2,690	1,580	1,590	160	780
Virginia pine	-	2,130	2,100	110	610
White pine	10,630	3,640	3,930	320	2,820
Mountain hardwoods	4,430	2,040	2,220	130	980
Cove hardwoods	4,180	2,590	2,810	180	1,570
All types	4,580	2,160	2,330	140	1,070

NORTHERN UNIT

Shortleaf-pitch pine	1,000	1,300	1,300	170	570
Virginia pine	-	2,230	2,200	110	650
White pine	10,000	4,220	4,290	350	3,480
Mountain hardwoods	3,920	2,050	2,210	130	920
Cove hardwoods	5,090	2,870	3,190	200	1,800
All types	4,090	2,190	2,320	140	990

SOUTHERN UNIT

Shortleaf-pitch pine	4,380	1,880	1,890	160	1,100
Virginia pine	-	1,860	1,860	110	530
White pine	10,730	3,100	3,610	310	2,360
Mountain hardwoods	4,950	2,030	2,230	130	1,030
Cove hardwoods	3,790	2,470	2,650	180	1,470
All types	4,980	2,140	2,340	140	1,140

1/Dead chestnut is not included.

Table A-6 - Net board foot volume, International 1/4-inch rule, by species and forest condition, 1940.

ENTIRE REGION

Species	Saw timber stands		Cordwood and reproduction stands	All conditions	
	Old growth	Second growth			
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	Percent
Softwoods:					
Shortleaf pine	14,000	399,600	96,000	509,600	10.3
Virginia pine	100	101,500	29,000	130,600	2.6
White pine	15,300	286,500	26,500	328,300	6.6
Hemlock-redcedar 1/	43,200	193,600	14,600	251,400	5.0
All softwoods	72,600	981,200	166,100	1,219,900	24.5
Hardwoods:					
Northern red oak	66,000	384,300	23,900	474,200	9.5
Other red oaks	55,400	443,500	43,100	542,000	10.9
White oak	129,800	544,700	21,800	696,300	14.0
Chestnut oak	168,300	591,900	44,500	804,700	16.2
Other white oaks	500	5,800	1,100	7,400	0.1
Yellowpoplar	39,500	287,000	21,500	348,000	7.0
Basswood	14,300	51,700	2,100	68,100	1.4
Red maple	10,200	48,100	4,200	62,500	1.3
Black gum	14,900	94,300	11,400	120,600	2.4
Birch	7,200	27,300	2,800	37,300	0.7
Hickory	31,900	189,000	15,200	236,100	4.8
Ash	1,200	26,600	1,900	29,700	0.6
Sugar maple	11,000	81,400	4,100	96,500	1.9
Cherry-walnut	2,200	40,200	7,800	50,200	1.0
Other hardwoods	14,800	155,600	11,900	182,300	3.7
All hardwoods	567,200	2,971,400	217,300	3,755,900	75.5
All live species 2/	639,800	3,952,600	383,400	4,975,800	100.0
	Percent	Percent	Percent	Percent	
Summary:					
Softwoods	6.0	80.4	13.6	100.0	
Hardwoods	15.1	79.1	5.8	100.0	

1/Includes 2.7 million board feet of red spruce.
2/Omitted are 444.4 million board feet of chestnut in saw timber stands and 314.0 million feet in cordwood and reproduction stands.

Table A-6. - Net board foot volume, International 1/4-inch rule, by species and forest condition, 1940.

NORTHERN UNIT

Species	Saw timber stands		Cordwood and reproduction stands	All conditions	
	Old growth	Second growth			
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	Percent
Softwoods:					
Shortleaf pine	9,800	189,800	63,500	263,100	11.7
Virginia pine	100	74,500	22,900	97,500	4.4
White pine	900	157,300	12,600	170,800	7.6
Hemlock-redcedar	5,500	109,400	3,500	118,400	5.3
All softwoods	16,300	531,000	102,500	649,800	29.0
Hardwoods:					
Northern red oak	40,600	200,800	11,300	252,700	11.3
Other red oaks	28,100	185,900	17,900	231,900	10.3
White oak	46,200	301,200	12,300	359,700	16.0
Chestnut oak	84,400	293,300	25,900	403,600	18.0
Other white oaks	-	4,000	-	4,000	0.2
Yellowpoplar	12,100	82,200	3,800	98,100	4.4
Basswood	5,900	18,600	1,300	25,800	1.2
Red maple	1,500	8,600	1,000	11,100	0.5
Black gum	6,500	24,200	4,500	35,200	1.6
Birch	-	10,500	700	11,200	0.5
Hickory	9,000	48,900	4,100	62,000	2.8
Ash	-	12,100	1,900	14,000	0.6
Sugar maple	-	33,500	1,200	34,700	1.5
Cherry-walnut	1,000	22,500	3,800	27,300	1.2
Other hardwoods	2,900	14,900	3,200	21,000	0.9
All hardwoods	238,200	1,261,200	92,900	1,592,300	71.0
All live species[1/]	254,500	1,792,200	195,400	2,242,100	100.0
	Percent	Percent	Percent	Percent	
Summary:					
Softwoods	2.5	81.7	15.8	100.0	
Hardwoods	15.0	79.2	5.8	100.0	

1/Does not include 208.2 million board feet of chestnut.

Table A-6. - Net board foot volume, International 1/4-inch rule, by species and forest condition, 1940.

SOUTHERN UNIT

Species	Saw timber stands		Cordwood and reproduction stands	All conditions	
	Old growth	Second growth			
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	Percent
Softwoods:					
Shortleaf pine	4,200	209,800	32,500	246,500	9.0
Virginia pine	-	27,000	6,100	33,100	1.2
White pine	14,400	129,200	13,900	157,500	5.8
Hemlock-redcedar	37,700	84,200	11,100	133,000	4.9
All softwoods	56,300	450,200	63,600	570,100	20.9
Hardwoods:					
Northern red oak	25,400	183,500	12,600	221,500	8.1
Other red oaks	27,300	257,600	25,200	310,100	11.3
White oak	83,600	243,500	9,500	336,600	12.3
Chestnut oak	83,900	298,600	18,600	401,100	14.7
Other white oaks	500	1,800	1,100	3,400	0.1
Yellowpoplar	27,400	204,800	17,700	249,900	9.1
Basswood	8,400	33,100	800	42,300	1.5
Red maple	8,700	39,500	3,200	51,400	1.9
Black gum	8,400	70,100	6,900	85,400	3.1
Birch	7,200	16,800	2,100	26,100	1.0
Hickory	22,900	140,100	11,100	174,100	6.4
Ash	1,200	14,500	-	15,700	0.6
Sugar maple	11,000	47,900	2,900	61,800	2.3
Cherry-walnut	1,200	17,700	4,000	22,900	0.8
Other hardwoods	11,900	140,700	8,700	161,300	5.9
All hardwoods	329,000	1,710,200	124,400	2,163,600	79.1
All live species[1/]	385,300	2,160,400	188,000	2,733,700	100.0
	Percent	Percent	Percent	Percent	
Summary:					
Softwoods	9.9	79.0	11.1	100.0	
Hardwoods	15.2	79.0	5.8	100.0	

1/Does not include 550.2 million board feet of dead chestnut.

Table A-7. - Net board foot volume, International 1/4-inch rule, by forest type and forest condition, 1940.1/

ENTIRE REGION

Forest type	Saw timber stands		Cordwood and reproduction stands	All conditions	
	Old growth	Second growth			
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	Percent
Shortleaf-pitch pine	4,300	359,200	49,100	412,600	8.3
Virginia pine	-	150,400	23,900	174,300	3.5
White pine	60,600	484,500	19,700	564,800	11.3
Mountain hardwoods	441,000	2,448,400	253,000	3,142,400	63.2
Cove hardwoods	133,900	510,100	37,700	681,700	13.7
All types	639,800	3,952,600	383,400	4,975,800	100.0

NORTHERN UNIT

Shortleaf-pitch pine	800	149,000	33,800	183,600	8.2
Virginia pine	-	113,600	16,800	130,400	5.8
White pine	8,000	272,700	5,900	286,600	12.8
Mountain hardwoods	196,300	1,093,000	127,100	1,416,400	63.2
Cove hardwoods	49,400	163,900	11,800	225,100	10.0
All types	254,500	1,792,200	195,400	2,242,100	100.0

SOUTHERN UNIT

Shortleaf-pitch pine	3,500	210,200	15,300	229,000	8.4
Virginia pine	-	36,800	7,100	43,900	1.6
White pine	52,600	211,800	13,800	278,200	10.2
Mountain hardwoods	244,700	1,355,400	125,900	1,726,000	63.1
Cove hardwoods	84,500	346,200	25,900	456,600	16.7
All types	385,300	2,160,400	188,000	2,733,700	100.0

1/Dead chestnut, amounting to 208.2 million board feet in the northern unit and 550.2 million board feet in the southern unit, is not included.

Table A-8. - Net board foot volume, International 1/4-inch rule, by species and tree-diameter class (inches), 1940.

ENTIRE REGION

Species	10 & 12	14, 16 & 18	20, 22 & 24	26 & over	All diameters
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.
Softwoods:					
Shortleaf pine	256,700	200,400	48,800	3,700	509,600
Virginia pine	104,300	26,300	-	-	130,600
White pine	92,100	131,500	65,000	39,700	328,300
Hemlock-redcedar	39,300	79,700	66,600	65,800	251,400
All softwoods	492,400	437,900	180,400	109,200	1,219,900
Hardwoods:					
Northern red oak	-	207,700	163,700	102,800	474,200
Other red oaks	-	364,400	133,700	43,900	542,000
White oak	-	292,400	241,000	162,900	696,300
Chestnut oak	-	386,700	266,900	151,100	804,700
Other white oaks	-	5,100	600	1,700	7,400
Yellowpoplar	-	195,600	93,800	58,600	348,000
Basswood	-	40,200	27,900	-	68,100
Red maple	-	33,900	28,600	-	62,500
Black gum	-	77,100	38,400	5,100	120,600
Birch	-	22,800	11,200	3,300	37,300
Hickory	-	149,700	73,400	13,000	236,100
Ash	-	19,200	8,200	2,300	29,700
Sugar maple	-	39,200	30,200	27,100	96,500
Cherry-walnut	-	31,200	13,200	5,800	50,200
Other hardwoods	-	105,700	61,900	14,700	182,300
All hardwoods	-	1,970,900	1,192,700	592,300	3,755,900
All live species[1/]	492,400	2,408,800	1,373,100	701,500	4,975,800
	Percent	Percent	Percent	Percent	Percent
Summary:					
Softwoods	40.4	35.9	14.8	8.9	100.0
Hardwoods	-	52.5	31.7	15.8	100.0

1/Dead chestnut amounts to 758.4 million board feet, 376.8 million feet in trees smaller than 20.0 inches d.b.h. and 381.6 million feet in trees 20.0 inches d.b.h. and larger.

Table A-8. - Net board foot volume, International 1/4-inch rule, by species and tree-diameter class (inches), 1940.1/

NORTHERN UNIT

Species	10 & 12	14, 16 & 18	20, 22 & 24	26 & over	All diameters
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.
Softwoods:					
Shortleaf pine	148,100	98,800	16,200	-	263,100
Virginia pine	76,400	21,100	-	-	97,500
Other	58,000	112,100	64,000	55,100	289,200
All softwoods	282,500	232,000	80,200	55,100	649,800
Hardwoods:					
Red oaks	-	270,800	154,200	59,600	484,600
White oaks	-	402,100	239,000	126,200	767,300
Yellowpoplar	-	56,200	25,800	16,100	98,100
Black gum	-	27,800	4,900	2,500	35,200
Hickory	-	38,900	19,100	4,000	62,000
Other	-	80,400	41,700	23,000	145,100
All hardwoods	-	876,200	484,700	231,400	1,592,300
All live species	282,500	1,108,200	564,900	286,500	2,242,100

SOUTHERN UNIT

Softwoods:					
Shortleaf pine	108,600	101,600	32,600	3,700	246,500
Virginia pine	27,900	5,200	-	-	33,100
Other	73,400	99,100	67,600	50,400	290,500
All softwoods	209,900	205,900	100,200	54,100	570,100
Hardwoods:					
Red oaks	-	301,300	143,200	87,100	531,600
White oaks	-	282,100	269,500	189,500	741,100
Yellowpoplar	-	139,400	68,000	42,500	249,900
Black gum	-	49,300	33,500	2,600	85,400
Hickory	-	110,800	54,300	9,000	174,100
Other	-	211,800	139,500	30,200	381,500
All hardwoods	-	1,094,700	708,000	360,900	2,163,600
All live species	209,900	1,300,600	808,200	415,000	2,733,700

1/Dead chestnut, amounting to 208.2 million board feet in the northern unit and 550.2 million board feet in the southern unit, is not included.

Table A-9. - Net cordwood volume of all sound material, including bark, by species and quality class, 1940.

ENTIRE REGION

Species	Saw timber trees		Cordwood trees	Cull trees	All trees	
	Sawlogs	Upper stems				
	Cords	Cords	Cords	Cords	Cords	Percent
Softwoods:						
Shortleaf pine	1,347,300	418,500	907,300	369,500	3,042,600	6.3
Virginia pine	357,300	113,600	619,800	190,600	1,281,300	2.7
White pine	734,000	163,100	189,100	104,900	1,919,100	2.5
Hemlock	537,600	99,900	96,200	83,200	816,900	1.7
Redcedar	30,000	-	70,600	900	101,500	0.2
All softwoods	3,006,200	795,100	1,883,000	749,100	6,433,400	13.4
Hardwoods:						
Northern red oak	1,224,200	682,700	867,000	838,000	3,611,900	7.6
Other red oaks	1,575,800	837,400	2,682,800	1,229,200	6,325,200	13.2
White oak	1,804,000	1,025,600	1,458,000	1,097,400	5,385,000	11.2
Chestnut oak	2,391,900	1,299,700	2,670,700	4,190,000	10,552,300	22.0
Other white oaks	21,900	11,800	53,000	46,800	133,500	0.3
Yellowpoplar	896,000	459,700	1,023,400	415,100	2,794,200	5.8
Basswood	195,700	99,300	257,100	198,700	750,800	1.6
Red maple	175,900	103,400	404,300	596,300	1,279,900	2.7
Black gum	356,600	133,600	153,200	430,400	1,073,800	2.2
Birch	100,600	59,500	218,600	291,100	669,800	1.4
Hickory	709,800	395,800	1,297,000	603,200	3,005,800	6.3
Ash	76,700	37,300	150,000	115,700	379,700	0.8
Sugar maple	259,200	158,500	155,100	307,200	880,000	1.8
Cherry-walnut	129,500	66,200	177,000	83,100	455,800	1.0
Other hardwoods	500,500	260,400	1,667,500	1,733,700	4,162,100	8.7
All hardwoods	10,418,300	5,630,900	13,234,700	12,175,900	41,459,800	86.6
All live species	13,424,500	6,426,000	15,117,700	12,925,000	47,893,200	100.0
Dead chestnut	2,552,500	1,083,000	2,174,400	904,400	6,714,300	-
All species	15,977,000	7,509,000	17,292,100	13,829,400	54,607,500	-
	Percent	Percent	Percent	Percent	Percent	
Summary:						
Softwoods	46.7	12.4	29.3	11.6	100.0	
Hardwoods	25.1	13.6	31.9	29.4	100.0	
Dead chestnut	38.0	16.1	32.4	13.5	100.0	

Table A-9. - Net cordwood volume of all sound material, including bark, by species and quality class, 1940.

NORTHERN UNIT

Species	Saw timber trees		Cordwood trees	Cull trees	All trees	
	Sawlogs	Upper stems				
	Cords	Cords	Cords	Cords	Cords	Percent
Softwoods:						
Shortleaf pine	707,000	235,200	624,500	236,200	1,802,900	7.9
Virginia pine	265,500	83,700	491,900	126,000	967,100	4.3
Other	646,500	129,100	132,800	72,800	981,200	4.3
All softwoods	1,619,000	448,000	1,249,200	435,000	3,751,200	16.5
Hardwoods:						
Red oaks	1,335,000	733,900	1,952,700	1,086,100	5,107,700	22.4
White oaks	2,163,800	1,202,900	2,762,500	3,007,000	9,136,200	40.2
Yellowpoplar	254,700	133,300	225,400	128,500	741,900	3.3
Black gum	106,600	39,400	68,900	149,100	364,000	1.6
Hickory	185,300	103,700	522,100	261,200	1,072,300	4.7
Other	391,400	216,300	1,147,200	819,800	2,574,700	11.3
All hardwoods	4,436,800	2,429,500	6,678,800	5,451,700	18,996,800	83.5
All live species	6,055,800	2,877,500	7,928,000	5,886,700	22,748,000	100.0
Dead chestnut	708,300	316,700	746,200	115,400	1,886,600	-
All species	6,764,100	3,194,200	8,674,200	6,002,100	24,634,600	-

SOUTHERN UNIT

Softwoods:						
Shortleaf pine	640,300	183,300	282,800	133,300	1,239,700	4.9
Virginia pine	91,800	29,900	127,900	64,600	314,200	1.3
Other	655,100	133,900	223,100	116,200	1,128,300	4.5
All softwoods	1,387,200	347,100	633,800	314,100	2,682,200	10.7
Hardwoods:						
Red oaks	1,465,000	786,200	1,597,100	981,100	4,829,400	19.2
White oaks	2,054,000	1,134,200	1,419,200	2,327,200	6,934,600	27.6
Yellowpoplar	641,300	326,400	798,000	286,600	2,052,300	8.1
Black gum	250,000	94,200	84,300	281,300	709,800	2.8
Hickory	524,500	292,100	774,900	342,000	1,933,500	7.7
Other	1,046,700	568,300	1,882,400	2,506,000	6,003,400	23.9
All hardwoods	5,981,500	3,201,400	6,555,900	6,724,200	22,463,000	89.3
All live species	7,368,700	3,548,500	7,189,700	7,038,300	25,145,200	100.0
Dead chestnut	1,844,200	766,300	1,428,200	789,000	4,827,700	-
All species	9,212,900	4,314,800	8,617,900	7,827,300	29,972,900	-

Table A-10. - Net cordwood volume of sound trees by species and tree-diameter class (inches), 1940.1/

ENTIRE REGION

Species	6 & 8	10 & 12	14, 16 & 18	20 & over	All diameters	
	Cords	Cords	Cords	Cords	Cords	Percent
Softwoods:						
Shortleaf pine	907,300	1,020,100	608,900	136,800	2,673,100	9.1
Virginia pine	619,800	394,000	76,900	-	1,090,700	3.7
White pine	189,100	309,900	347,000	240,200	1,086,200	3.7
Hemlock	96,200	117,900	208,300	311,300	733,700	2.5
Redcedar	70,600	21,700	8,300	-	100,600	0.4
All softwoods	1,883,000	1,863,600	1,249,400	688,300	5,684,300	19.4
Hardwoods:						
Northern red oak	321,700	545,300	583,800	640,400	2,091,200	7.1
Other red oaks	1,247,400	1,435,400	1,110,300	465,500	4,258,600	14.5
White oak	646,500	811,500	804,200	999,800	3,262,000	11.1
Chestnut oak	1,205,300	1,465,400	1,202,800	1,189,100	5,062,600	17.3
Other white oaks	22,600	30,400	15,500	6,400	74,900	0.3
Yellowpoplar	460,400	563,000	533,900	362,100	1,919,400	6.6
Basswood	112,100	145,000	118,500	77,200	452,800	1.6
Red maple	237,600	166,700	98,400	77,500	580,200	2.0
Black gum	52,500	100,700	241,100	115,500	509,800	1.7
Birch	95,500	123,100	65,900	34,700	319,200	1.1
Hickory	548,200	748,800	470,000	239,800	2,006,800	6.8
Ash	74,600	75,400	51,800	24,900	226,700	0.8
Sugar maple	78,900	76,200	112,200	147,000	414,300	1.4
Cherry-walnut	72,000	105,000	84,800	44,700	306,500	1.0
Other hardwoods	762,500	688,200	483,500	233,800	2,168,000	7.3
All hardwoods	5,937,800	7,080,100	5,976,700	4,658,400	23,653,000	80.6
All live species	7,820,800	8,943,700	7,226,100	5,346,700	29,337,300	100.0
Dead chestnut	794,800	1,379,600	1,335,400	1,217,100	4,726,900	-
All species	8,615,600	10,323,300	8,561,500	6,563,800	34,064,200	-
	Percent	Percent	Percent	Percent	Percent	
Summary:						
Softwoods	33.1	32.8	22.0	12.1	100.0	
Hardwoods	25.1	29.9	25.3	19.7	100.0	
Dead chestnut	16.8	29.2	28.3	25.7	100.0	

1/Cull trees and upper stems and limbs of saw timber size hardwoods and chestnut not included.

Table A-10. - Net cordwood volume of sound trees by species and tree-diameter class (inches), 1940.

NORTHERN UNIT

Species	6 & 8	10 & 12	14, 16 & 18	20 & over	All diameters	
	Cords	Cords	Cords	Cords	Cords	Percent
Softwoods:						
Shortleaf pine	624,500	597,600	302,100	42,500	1,566,700	10.9
Virginia pine	491,900	288,000	61,200	-	841,100	5.8
Other	132,800	199,100	299,200	277,300	908,400	6.3
All softwoods	1,249,200	1,084,700	662,500	319,800	3,316,200	23.0
Hardwoods:						
Red oaks	944,100	1,008,600	801,500	533,500	3,287,700	22.8
White oaks	1,256,100	1,506,400	1,188,600	975,200	4,926,300	34.1
Yellowpoplar	89,500	135,900	154,200	100,500	480,100	3.3
Black gum	21,100	47,800	87,200	19,400	175,500	1.2
Hickory	228,800	293,300	121,900	63,400	707,400	4.9
Other	531,500	507,500	315,300	184,300	1,538,600	10.7
All hardwoods	3,071,100	3,499,500	2,668,700	1,876,300	11,115,600	77.0
All live species	4,320,300	4,584,200	3,331,200	2,196,100	14,431,800	100.0
Dead chestnut	286,200	460,000	363,500	344,800	1,454,500	-
All species	4,606,500	5,044,200	3,694,700	2,540,900	15,886,300	-

SOUTHERN UNIT

Softwoods:						
Shortleaf pine	282,800	422,500	306,800	94,300	1,106,400	7.4
Virginia pine	127,900	106,000	15,700	-	249,600	1.7
Other	223,100	250,400	264,400	274,200	1,012,100	6.8
All softwoods	633,800	778,900	586,900	368,500	2,368,100	15.9
Hardwoods:						
Red oaks	625,000	972,100	892,600	572,400	3,062,100	20.5
White oaks	618,300	800,900	833,900	1,220,100	3,473,200	23.3
Yellowpoplar	370,900	427,100	379,700	261,600	1,439,300	9.7
Black gum	31,400	52,900	153,900	96,100	334,300	2.2
Hickory	319,400	455,500	348,100	176,400	1,299,400	8.7
Other	901,700	872,100	699,800	455,500	2,929,100	19.7
All hardwoods	2,866,700	3,580,600	3,308,000	2,782,100	12,537,400	84.1
All live species	3,500,500	4,359,500	3,894,900	3,150,600	14,905,500	100.0
Dead chestnut	508,600	919,600	971,900	872,300	3,272,400	-
All species	4,009,100	5,279,100	4,866,800	4,022,900	18,177,900	-

Table A-11. - Average cordwood volume per acre by forest type and forest condition, 1940.1/

ENTIRE REGION

Forest type	Saw timber stands			Cordwood and reproduction stands	All conditions
	Old growth	Second growth	Average		
	Cords	Cords	Cords	Cords	Cords
Shortleaf-pitch pine	9.06	8.13	8.14	2.60	4.99
Virginia pine	0.38	12.41	12.28	2.90	5.25
White pine	29.81	13.76	14.42	4.17	11.27
Mountain hardwoods	14.47	9.76	10.12	3.18	5.99
Cove hardwoods	13.68	11.92	12.17	4.38	8.48
All types	14.77	10.19	10.51	3.21	6.29

NORTHERN UNIT

Shortleaf-pitch pine	6.50	7.80	7.79	2.84	4.63
Virginia pine	0.38	12.98	12.79	3.34	5.76
White pine	27.00	14.92	15.07	4.25	12.85
Mountain hardwoods	13.15	10.23	10.48	3.61	6.20
Cove hardwoods	16.27	13.13	13.58	4.31	9.27
All types	13.56	10.63	10.84	3.51	6.35

SOUTHERN UNIT

Shortleaf-pitch pine	11.62	8.47	8.49	2.07	5.54
Virginia pine	-	10.94	10.94	1.85	4.01
White pine	30.27	12.65	13.83	4.14	10.17
Mountain hardwoods	15.80	9.40	9.84	2.76	5.79
Cove hardwoods	12.55	11.43	11.58	4.40	8.17
All types	15.74	9.83	10.25	2.89	6.23

1/Dead chestnut, cull trees, and upper stems and limbs of saw timber size hardwoods not included.

Table A-12. - Net cubic foot volume of all sound wood, without bark, by species and quality class, 1940.

ENTIRE REGION

Species	Saw timber trees		Cordwood trees	Cull trees	All trees	
	Sawlogs	Upper stems				
	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	Percent
Softwoods:						
Shortleaf pine	97,790	29,870	62,700	25,690	216,050	7.1
Virginia pine	27,950	7,860	46,300	13,810	95,920	3.1
White pine	57,790	12,150	14,550	8,090	92,580	3.0
Hemlock	42,560	7,890	7,390	6,570	64,410	2.1
Redcedar	2,300	-	5,660	60	8,020	0.3
All softwoods	228,390	57,770	136,600	54,220	476,980	15.6
Hardwoods:						
Northern red oak	80,670	38,890	52,590	53,860	226,010	7.4
Other red oaks	102,460	49,390	163,000	76,870	391,720	12.8
White oak	119,990	58,040	94,330	71,390	343,750	11.3
Chestnut oak	149,360	71,090	156,290	259,400	636,140	20.8
Other white oaks	1,370	650	3,080	2,870	7,970	0.3
Yellowpoplar	57,670	25,930	64,130	26,970	174,700	5.7
Basswood	13,320	6,040	16,900	13,360	49,620	1.6
Red maple	11,850	5,980	26,890	39,180	83,900	2.7
Black gum	22,940	7,760	10,450	29,690	70,840	2.3
Birch	6,980	3,680	14,210	19,580	44,450	1.5
Hickory	46,800	21,410	79,370	37,600	185,180	6.1
Ash	5,130	2,170	9,030	7,250	23,580	0.8
Sugar maple	17,720	9,360	10,320	20,740	58,140	1.9
Cherry-walnut	8,660	3,830	10,710	5,350	28,550	0.9
Other hardwoods	33,970	15,890	98,270	105,670	253,800	8.3
All hardwoods	678,890	320,110	809,570	769,780	2,578,350	84.4
All species	907,280	377,880	946,170	824,000	3,055,330	100.0
	Percent	Percent	Percent	Percent	Percent	
Summary:						
Softwoods	47.9	12.1	28.6	11.4	100.0	
Hardwoods	26.3	12.4	31.4	29.9	100.0	

Table A-12. - Net cubic foot volume of all sound wood, without bark, by species and quality class, 1940.

NORTHERN UNIT

Species	Saw timber trees		Cordwood trees	Cull trees	All trees	
	Sawlogs	Upper stems				
	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	Percent
Softwoods:						
Shortleaf pine	51,050	16,640	43,140	16,250	127,080	8.8
Virginia pine	20,810	5,800	36,820	9,150	72,580	5.0
Other	50,850	9,870	10,310	5,650	76,680	5.3
All softwoods	122,710	32,310	90,270	31,050	276,340	19.1
Hardwoods:						
Red oaks	87,240	42,500	118,610	68,770	317,120	21.9
White oaks	138,830	66,580	167,530	187,670	560,610	38.7
Yellowpoplar	16,370	7,520	14,050	8,440	46,380	3.2
Black gum	6,830	2,290	4,710	9,560	23,390	1.6
Hickory	12,240	5,610	31,900	16,230	65,980	4.5
Other	26,560	12,860	69,240	51,470	160,130	11.0
All hardwoods	288,070	137,360	406,040	342,140	1,173,610	80.9
All species	410,780	169,670	496,310	373,190	1,449,950	100.0

SOUTHERN UNIT

Softwoods:						
Shortleaf pine	46,740	13,230	19,560	9,440	88,970	5.5
Virginia pine	7,140	2,060	9,480	4,660	23,340	1.5
Other	51,800	10,170	17,290	9,070	88,330	5.5
All softwoods	105,680	25,460	46,330	23,170	200,640	12.5
Hardwoods:						
Red oaks	95,890	45,780	96,980	61,960	300,610	18.7
White oaks	131,890	63,200	86,170	145,990	427,250	26.6
Yellowpoplar	41,300	18,410	50,080	18,530	128,320	8.0
Black gum	16,110	5,470	5,740	20,130	47,450	3.0
Hickory	34,560	15,800	47,470	21,370	119,200	7.4
Other	71,070	34,090	117,090	159,660	381,910	23.8
All hardwoods	390,820	182,750	403,530	427,640	1,404,740	87.5
All species	496,500	208,210	449,860	450,810	1,605,380	100.0

Table A-13. - Net growth in board feet, International 1/4-inch rule, by species group and tree-diameter class (inches), 1940.

ENTIRE REGION

Species group	10 & 12	14, 16 & 18	20 & over	All diameters	
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	Percent
Softwoods:					
Shortleaf pine	10,700	9,200	1,500	21,400	9.0
Virginia pine	13,300	3,000	-	16,300	6.8
Other	7,200	5,800	7,200	20,200	8.5
All softwoods	31,200	18,000	8,700	57,900	24.3
Hardwoods:					
Oaks	-	50,900	51,500	102,400	43.0
Yellowpoplar[1/]	-	21,200	11,700	32,900	13.8
Other	-	28,500	16,500	45,000	18.9
All hardwoods	-	100,600	79,700	180,300	75.7
All species	31,200	118,600	88,400	238,200	100.0

NORTHERN UNIT

Softwoods:					
Shortleaf pine	7,500	4,800	1,000	13,300	13.5
Virginia pine	9,100	2,100	-	11,200	11.4
Other	2,400	1,500	2,500	6,400	6.5
All softwoods	19,000	8,400	3,500	30,900	31.4
Hardwoods:					
Oaks	-	26,000	21,900	47,900	48.7
Yellowpoplar[1/]	-	4,700	2,200	6,900	7.0
Other	-	8,100	4,600	12,700	12.9
All hardwoods	-	38,800	28,700	67,500	68.6
All species	19,000	47,200	32,200	98,400	100.0

SOUTHERN UNIT

Softwoods:					
Shortleaf pine	3,200	4,400	500	8,100	5.8
Virginia pine	4,200	900	-	5,100	3.6
Other	4,800	4,300	4,700	13,800	9.9
All softwoods	12,200	9,600	5,200	27,000	19.3
Hardwoods:					
Oaks	-	24,900	29,600	54,500	39.0
Yellowpoplar[1/]	-	16,500	9,500	26,000	18.6
Other	-	20,400	11,900	32,300	23.1
All hardwoods	-	61,800	51,000	112,800	80.7
All species	12,200	71,400	56,200	139,800	100.0

1/Includes black gum.

Table A-14. - Net growth in cords by species group and tree-diameter class (inches), 1940.

ENTIRE REGION

Species group	6 & 8	10 & 12	14, 16 & 18	20 & over	All diameters	
	Cords	Cords	Cords	Cords	Cords	Percent
Softwoods:						
Shortleaf pine	14,700	41,500	30,400	4,000	90,600	6.6
Virginia pine	48,800	45,600	10,500	-	104,900	7.6
Other	20,800	23,200	15,700	17,200	76,900	5.6
All softwoods	84,300	110,300	56,600	21,200	272,400	19.8
Hardwoods:						
Oaks	169,400	111,900	150,900	133,600	565,800	41.1
Yellowpoplar[1/]	38,100	26,900	48,700	28,200	141,900	10.3
Other	193,600	61,800	95,500	45,900	396,800	28.8
All hardwoods	401,100	200,600	295,100	207,700	1,104,500	80.2
All species	485,400	310,900	351,700	228,900	1,376,900	100.0

NORTHERN UNIT

Softwoods:						
Shortleaf pine	8,700	30,200	16,000	2,900	57,800	9.6
Virginia pine	25,200	30,200	7,500	-	62,900	10.4
Other	3,100	8,100	3,000	5,700	19,900	3.3
All softwoods	37,000	68,500	26,500	8,600	140,600	23.3
Hardwoods:						
Oaks	107,600	70,300	77,100	56,900	311,900	51.6
Yellowpoplar[1/]	1,300	2,100	11,800	5,400	20,600	3.4
Other	68,000	20,600	31,200	11,600	131,400	21.7
All hardwoods	176,900	93,000	120,100	73,900	463,900	76.7
All species	213,900	161,500	146,600	82,500	604,500	100.0

SOUTHERN UNIT

Softwoods:						
Shortleaf pine	6,000	11,300	14,400	1,100	32,800	4.3
Virginia pine	23,600	15,400	3,000	-	42,000	5.4
Other	17,700	15,100	12,700	11,500	57,000	7.4
All softwoods	47,300	41,800	30,100	12,600	131,800	17.1
Hardwoods:						
Oaks	61,800	41,600	73,800	76,700	253,900	32.9
Yellowpoplar[1/]	36,800	24,800	36,900	22,800	121,300	15.7
Other	125,600	41,200	64,300	34,300	265,400	34.3
All hardwoods	224,200	107,600	175,000	133,800	640,600	82.9
All species	271,500	149,400	205,100	146,400	772,400	100.0

1/Includes black gum.

Table A-15. - Net growth in cubic feet by species group and tree-diameter class (inches), 1940.

ENTIRE REGION

Species group	6 & 8	10 & 12	14, 16 & 18	20 & over	All diameters	
	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	Percent
Softwoods:						
Shortleaf pine	1,020	2,930	2,210	330	6,490	7.2
Virginia pine	3,630	3,460	800	-	7,890	8.8
Other	1,600	1,800	1,230	1,350	5,980	6.6
All softwoods	6,250	8,190	4,240	1,680	20,360	22.6
Hardwoods:						
Oaks	10,260	6,830	9,670	8,720	35,480	39.4
Yellowpoplar 1/	2,400	1,700	3,110	1,850	9,060	10.0
Other	11,940	3,960	6,230	3,090	25,220	28.0
All hardwoods	24,600	12,490	19,010	13,660	69,760	77.4
All species	30,850	20,680	23,250	15,340	90,120	100.0

NORTHERN UNIT

Softwoods:						
Shortleaf pine	600	2,130	1,160	230	4,120	10.5
Virginia pine	1,890	2,290	570	-	4,750	12.0
Other	230	620	230	450	1,530	3.9
All softwoods	2,720	5,040	1,960	680	10,400	26.4
Hardwoods:						
Oaks	6,510	4,280	4,910	3,730	19,430	49.4
Yellowpoplar 1/	80	130	760	350	1,320	3.3
Other	4,140	1,290	2,010	780	8,220	20.9
All hardwoods	10,730	5,700	7,680	4,860	28,970	73.6
All species	13,450	10,740	9,640	5,540	39,370	100.0

SOUTHERN UNIT

Softwoods:						
Shortleaf pine	420	800	1,050	100	2,370	4.6
Virginia pine	1,740	1,170	230	-	3,140	6.2
Other	1,370	1,180	1,000	900	4,450	8.8
All softwoods	3,530	3,150	2,280	1,000	9,960	19.6
Hardwoods:						
Oaks	3,750	2,550	4,760	4,990	16,050	31.6
Yellowpoplar 1/	2,320	1,570	2,350	1,500	7,740	15.3
Other	7,800	2,670	4,220	2,310	17,000	33.5
All hardwoods	13,870	6,790	11,330	8,800	40,790	80.4
All species	17,400	9,940	13,610	9,800	50,750	100.0

1/Includes black gum.

Table A-16. - Average net growth per acre in the entire region by forest type and species group, 1940.

SAW TIMBER STANDS

Forest type	Softwoods			Hardwoods			All species
	Shortleaf pine	Virginia pine	Other	Oaks	Yellow-poplar, black gum	Other	
	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.	Bd.ft.
Shortleaf-pitch pine	40	2	2	6	2	1	53
Virginia pine	7	75	5	16	2	3	108
White pine	3	1	77	20	4	16	121
Mountain hardwoods	3	1	2	49	9	14	78
Cove hardwoods	Negl.	1	3	27	33	56	120
All types	7	3	8	38	11	17	84

CORDWOOD STANDS

	Cords	Cords	Cords	Cords	Cords	Cords	Cords
Shortleaf-pitch pine	.105	.013	.006	.037	-	.005	.166
Virginia pine	.011	.203	.008	.047	.006	.017	.292
White pine	.011	.009	.171	.097	.018	.095	.401
Mountain hardwoods	.009	.005	.007	.143	.020	.080	.264
Cove hardwoods	.001	.001	.008	.048	.206	.232	.496
All types	.019	.022	.011	.115	.031	.078	.276

Table A-17. - Volume of wood processed by the primary forest products industries, 1940.

Product	Number of plants	Production or consumption					
		Shortleaf & Virginia pines	Other soft-woods	Oaks	Gums, yellow-poplar	Other hard-woods	Total
		M bd. ft.	M bd.ft.	M bd.ft.	M bd.ft.	M bd.ft.	M bd. ft.
Lumber[1/]	999	11,000	26,700	100,800	20,900	38,100	197,500
Veneer	5	-	500	1,200	2,900	1,000	5,600
		Cords	Cords	Cords	Cords	Cords	Cords
Cooperage	4	-	-	2,300	700	100	3,100
Tanning materials	9	-	-	8,400	-	97,900	106,300
Mine props	-	8,900	1,200	34,800	14,400	45,300	104,600
Fuelwood	-	100,200	41,100	514,000	85,500	302,300	1,043,100
Fence posts	-	100	1,800	300	-	33,300	35,500
Miscellaneous[2/]	15	251,200	-	12,200	62,600	29,400	355,400
		M pcs.	M pcs.	M pcs.	M pcs.	M pcs.	M pcs.
Hewn crossties	-	-	-	54	-	-	54

1/Includes lumber tally equivalent of all material produced in sawmills.
2/Includes 3 pulp mills, 5 handle plants, 1 wood turning plant, 3 insulator pin plants, 1 shingle mill, 1 box plant, and 1 mine wedge plant.

Table A-18. - Commodity drain in board feet, International 1/4-inch rule, by species group and tree-diameter class (inches), 1940.

ENTIRE REGION

Species group	10 & 12	14, 16 & 18	20 & over	All diameters	
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	Percent
Softwoods:					
Shortleaf pine	7,400	6,300	1,500	15,200	7.2
Virginia pine	4,900	3,500	-	8,400	4.0
Other	2,600	11,800	12,500	26,900	12.7
All softwoods	14,900	21,600	14,000	50,500	23.9
Hardwoods:					
Oaks	-	48,500	58,300	106,800	50.5
Yellowpoplar 1/	-	13,400	9,600	23,000	10.9
Other	-	16,600	14,600	31,200	14.7
All hardwoods	-	78,500	82,500	161,000	76.1
All live species	14,900	100,100	96,500	211,500	100.0

NORTHERN UNIT

Softwoods:					
Shortleaf pine	5,400	3,000	300	8,700	13.2
Virginia pine	4,000	2,600	-	6,600	10.0
Other	600	2,800	2,900	6,300	9.6
All softwoods	10,000	8,400	3,200	21,600	32.8
Hardwoods:					
Oaks	-	17,100	18,600	35,700	54.2
Yellowpoplar 1/	-	3,200	1,700	4,900	7.4
Other	-	2,400	1,300	3,700	5.6
All hardwoods	-	22,700	21,600	44,300	67.2
All live species	10,000	31,100	24,800	65,900	100.0

SOUTHERN UNIT

Softwoods:					
Shortleaf pine	2,000	3,300	1,200	6,500	4.5
Virginia pine	900	900	-	1,800	1.2
Other	2,000	9,000	9,600	20,600	14.1
All softwoods	4,900	13,200	10,800	28,900	19.8
Hardwoods:					
Oaks	-	31,400	39,700	71,100	48.8
Yellowpoplar 1/	-	10,200	7,900	18,100	12.5
Other	-	14,200	13,300	27,500	18.9
All hardwoods	-	55,800	60,900	116,700	80.2
All live species	4,900	69,000	71,700	145,600	100.0

1/Includes black gum.

Table A-19. - Commodity drain in cords by species group and tree-diameter class (inches), 1940.

ENTIRE REGION

Species group	6 & 8	10 & 12	14, 16 & 18	20 & over	All diameters	
	Cords	Cords	Cords	Cords	Cords	Percent
Softwoods:						
Shortleaf pine	26,400	29,700	18,800	4,000	78,900	8.5
Virginia pine	16,100	18,200	10,200	-	44,500	4.8
Other	2,100	8,400	31,300	28,800	70,600	7.7
All softwoods	44,600	56,300	60,300	32,800	194,000	21.0
Hardwoods:						
Oaks	55,700	85,900	142,100	153,000	436,700	47.3
Yellowpoplar 1/	19,200	29,200	37,700	23,500	109,600	11.9
Other	45,800	50,700	48,800	38,100	183,400	19.8
All hardwoods	120,700	165,800	228,600	214,600	729,700	79.0
All live species	165,300	222,100	288,900	247,400	923,700	100.0

NORTHERN UNIT

Softwoods:						
Shortleaf pine	20,300	22,000	9,300	900	52,500	15.1
Virginia pine	13,800	14,800	7,500	-	36,100	10.4
Other	800	2,200	7,400	6,800	17,200	4.9
All softwoods	34,900	39,000	24,200	7,700	105,800	30.4
Hardwoods:						
Oaks	28,500	41,400	50,200	48,300	168,400	48.3
Yellowpoplar 1/	8,700	12,300	9,200	4,100	34,300	9.9
Other	14,800	14,800	6,900	3,300	39,800	11.4
All hardwoods	52,000	68,500	66,300	55,700	242,500	69.6
All live species	86,900	107,500	90,500	63,400	348,300	100.0

SOUTHERN UNIT

Softwoods:						
Shortleaf pine	6,100	7,700	9,500	3,100	26,400	4.6
Virginia pine	2,300	3,400	2,700	-	8,400	1.4
Other	1,300	6,200	23,900	22,000	53,400	9.3
All softwoods	9,700	17,300	36,100	25,100	88,200	15.3
Hardwoods:						
Oaks	27,200	44,500	91,900	104,700	268,300	46.6
Yellowpoplar 1/	10,500	16,900	28,500	19,400	75,300	13.1
Other	31,000	35,900	41,900	34,800	143,600	25.0
All hardwoods	68,700	97,300	162,300	158,900	487,200	84.7
All live species	78,400	114,600	198,400	184,000	575,400	100.0

1/Includes black gum.

Table A-20. - Commodity drain in cubic feet by species group and tree-diameter class (inches), 1940.

ENTIRE REGION

Species group	6 & 8	10 & 12	14, 16 & 18	20 & over	All diameters	
	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	Percent
Softwoods:						
Shortleaf pine	1,820	2,110	1,380	320	5,630	9.2
Virginia pine	1,190	1,400	780	-	3,370	5.5
Other	160	660	2,450	2,280	5,550	9.0
All softwoods	3,170	4,170	4,610	2,600	14,550	23.7
Hardwoods:						
Oaks	3,370	5,240	9,150	9,980	27,740	45.3
Yellowpoplar[1/]	1,210	1,860	2,390	1,550	7,010	11.4
Other	2,910	3,220	3,260	2,590	11,980	19.6
All hardwoods	7,490	10,320	14,800	14,120	46,730	76.3
All live species	10,660	14,490	19,410	16,720	61,280	100.0

NORTHERN UNIT

Softwoods:						
Shortleaf pine	1,400	1,560	680	70	3,710	16.0
Virginia pine	1,030	1,130	580	-	2,740	11.8
Other	60	170	570	540	1,340	5.8
All softwoods	2,490	2,860	1,830	610	7,790	33.6
Hardwoods:						
Oaks	1,720	2,530	3,220	3,160	10,630	45.9
Yellowpoplar[1/]	550	790	580	270	2,190	9.5
Other	930	930	470	220	2,550	11.0
All hardwoods	3,200	4,250	4,270	3,650	15,370	66.4
All live species	5,690	7,110	6,100	4,260	23,160	100.0

SOUTHERN UNIT

Softwoods:						
Shortleaf pine	420	550	700	250	1,920	5.0
Virginia pine	160	270	200	-	630	1.7
Other	100	490	1,880	1,740	4,210	11.0
All softwoods	680	1,310	2,780	1,990	6,760	17.7
Hardwoods:						
Oaks	1,650	2,710	5,930	6,820	17,110	44.9
Yellowpoplar[1/]	660	1,070	1,810	1,280	4,820	12.7
Other	1,980	2,290	2,790	2,370	9,430	24.7
All hardwoods	4,290	6,070	10,530	10,470	31,360	82.3
All live species	4,970	7,380	13,310	12,460	38,120	100.0

1/Includes black gum.

Table A-21. - Comparison between growth and drain in the entire region by species group, 1940.

SAW TIMBER

Species group	Growing stock Jan.-1940	Net increment 1/	Commodity drain	Net change	Growing stock Jan.-1941
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.
Softwoods:					
Shortleaf pine	503,400	21,400	15,200	6,200	509,600
Virginia pine	122,700	16,300	8,400	7,900	130,600
Other	586,400	20,200	26,900	-6,700	579,700
All softwoods	1,212,500	57,900	50,500	7,400	1,219,900
Hardwoods:					
Oaks	2,529,000	102,400	106,800	-4,400	2,524,600
Yellowpoplar 2/	458,700	32,900	23,000	9,900	468,600
Other	748,900	45,000	31,200	13,800	762,700
All hardwoods	3,736,600	180,300	161,000	19,300	3,755,900
All live species	4,949,100	238,200	211,500	26,700	4,975,800

ALL SOUND TREES 5.0 INCHES D.B.H. AND LARGER

	Cords	Cords	Cords	Cords	Cords
Softwoods:					
Shortleaf pine	2,661,400	90,600	78,900	11,700	2,673,100
Virginia pine	1,030,300	104,900	44,500	60,400	1,090,700
Other	1,914,200	76,900	70,600	6,300	1,920,500
All softwoods	5,605,900	272,400	194,000	78,400	5,684,300
Hardwoods:					
Oaks	14,620,200	565,800	436,700	129,100	14,749,300
Yellowpoplar 2/	2,396,900	141,900	109,600	32,300	2,429,200
Other	6,261,100	396,800	183,400	213,400	6,474,500
All hardwoods	23,278,200	1,104,500	729,700	374,800	23,653,000
All live species	28,884,100	1,376,900	923,700	453,200	29,337,300
	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.
Softwoods:					
Shortleaf pine	189,500	6,490	5,630	860	190,360
Virginia pine	77,590	7,890	3,370	4,520	82,110
Other	149,860	5,980	5,550	430	150,290
All softwoods	416,950	20,360	14,550	5,810	422,760
Hardwoods:					
Oaks	915,400	35,480	27,740	7,740	923,140
Yellowpoplar 2/	153,140	9,060	7,010	2,050	155,190
Other	396,890	25,220	11,980	13,240	410,130
All hardwoods	1,465,430	69,760	46,730	23,030	1,488,460
All live species	1,882,380	90,120	61,280	28,840	1,911,220

1/Increment minus mortality.
2/Includes black gum.

Table A-22. - Comparison between growth and drain in the entire region by tree-diameter class, 1940.

SAW TIMBER

Tree-diameter class (inches)	Growing stock Jan.-1940	Net increment 1/	Commodity drain	Net change	Growing stock Jan.-1941
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.
Softwoods:					
10 & 12	476,100	31,200	14,900	16,300	492,400
14, 16, & 18	441,500	18,000	21,600	-3,600	437,900
20 & over	294,900	8,700	14,000	-5,300	289,600
All softwoods	1,212,500	57,900	50,500	7,400	1,219,900
Hardwoods:					
14, 16, & 18	1,948,800	100,600	78,500	22,100	1,970,900
20 & over	1,787,800	79,700	82,500	-2,800	1,785,000
All hardwoods	3,736,600	180,300	161,000	19,300	3,755,900
All live species	4,949,100	238,200	211,500	26,700	4,975,800

ALL SOUND TREES 5.0 INCHES D.B.H. AND LARGER

	Cords	Cords	Cords	Cords	Cords
Softwoods:					
6 & 8	1,843,300	84,300	44,600	39,700	1,883,000
10 & 12	1,809,600	110,300	56,300	54,000	1,863,600
14, 16, & 18	1,253,100	56,600	60,300	-3,700	1,249,400
20 & over	699,900	21,200	32,800	-11,600	688,300
All softwoods	5,605,900	272,400	194,000	78,400	5,684,300
Hardwoods:					
6 & 8	5,657,400	401,100	120,700	280,400	5,937,800
10 & 12	7,045,300	200,600	165,800	34,800	7,080,100
14, 16, & 18	5,910,200	295,100	228,600	66,500	5,976,700
20 & over	4,665,300	207,700	214,600	-6,900	4,658,400
All hardwoods	23,278,200	1,104,500	729,700	374,800	23,653,000
All live species	28,884,100	1,376,900	923,700	453,200	29,337,300
	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.
Softwoods:					
6 & 8	133,520	6,250	3,170	3,080	136,600
10 & 12	133,550	8,190	4,170	4,020	137,570
14, 16, & 18	94,930	4,240	4,610	-370	94,560
20 & over	54,950	1,680	2,600	-920	54,030
All softwoods	416,950	20,360	14,550	5,810	422,760
Hardwoods:					
6 & 8	345,010	24,600	7,490	17,110	362,120
10 & 12	433,090	12,490	10,320	2,170	435,260
14, 16, & 18	379,970	19,010	14,800	4,210	384,180
20 & over	307,360	13,660	14,120	-460	306,900
All hardwoods	1,465,430	69,760	46,730	23,030	1,488,460
All live species	1,882,380	90,120	61,280	28,840	1,911,220

1/Increment minus mortality.

Table A-23. - Net change in the total sound-tree growing stock by species group and tree-diameter class (inches), 1940.

ENTIRE REGION

Species group	6 & 8	10 & 12	14, 16 & 18	20 & over	All diameters
	Cords	Cords	Cords	Cords	Cords
Softwoods:					
Shortleaf pine	-11,700	11,800	11,600	-	11,700
Virginia pine	32,700	27,400	300	-	60,400
Other	18,700	14,800	-15,600	-11,600	6,300
All softwoods	39,700	54,000	-3,700	-11,600	78,400
Hardwoods:					
Oaks	113,700	26,000	8,800	-19,400	129,100
Yellowpoplar[1/]	18,900	-2,300	11,000	4,700	32,300
Other	147,800	11,100	46,700	7,800	213,400
All hardwoods	280,400	34,800	66,500	-6,900	374,800
All live species	320,100	88,800	62,800	-18,500	453,200

NORTHERN UNIT

Softwoods:					
Shortleaf pine	-11,600	8,200	6,700	2,000	5,300
Virginia pine	11,400	15,400	-	-	26,800
Other	2,300	5,900	-4,400	-1,100	2,700
All softwoods	2,100	29,500	2,300	900	34,800
Hardwoods:					
Oaks	79,100	28,900	26,900	8,600	143,500
Yellowpoplar[1/]	-7,400	-10,200	2,600	1,300	-13,700
Other	53,200	5,800	24,300	8,300	91,600
All hardwoods	124,900	24,500	53,800	18,200	221,400
All live species	127,000	54,000	56,100	19,100	256,200

SOUTHERN UNIT

Softwoods:					
Shortleaf pine	-100	3,600	4,900	-2,000	6,400
Virginia pine	21,300	12,000	300	-	33,600
Other	16,400	8,900	-11,200	-10,500	3,600
All softwoods	37,600	24,500	-6,000	-12,500	43,600
Hardwoods:					
Oaks	34,600	-2,900	-18,100	-28,000	-14,400
Yellowpoplar[1/]	26,300	7,900	8,400	3,400	46,000
Other	94,600	5,300	22,400	-500	121,800
All hardwoods	155,500	10,300	12,700	-25,100	153,400
All live species	193,100	34,800	6,700	-37,600	197,000

1/Includes black gum.

Table A-24. - Possible changes in volume of growing stock by species group and tree-diameter class with drain maintained at 1940 level for 30 years.

Tree-diameter class	Hardwoods		Softwoods	
	Volume in 1940	Volume in 1970	Volume in 1940	Volume in 1970
Inches	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.
	Oaks		Shortleaf pine	
6 & 8	201,434	436,702	63,495	38,436
10 & 12	259,398	542,032	71,853	78,717
14, 16, & 18	237,386	249,483	43,756	83,686
20 & over	217,194	142,928	10,417	15,845
All classes	915,412	1,371,145	189,521	216,684
	Gum and yellowpoplar		Virginia pine	
6 & 8	31,171	63,583	43,855	125,984
10 & 12	42,373	90,009	27,659	249,457
14, 16, & 18	48,440	118,818	5,856	86,543
20 & over	31,165	73,331	-	-
All classes	153,149	345,741	77,370	461,984
	Other hardwoods		Other softwoods	
6 & 8	112,413	434,165	26,153	74,117
10 & 12	131,308	426,058	33,845	143,991
14, 16, & 18	129,842	434,887	45,315	75,835
20 & over	23,304	86,779	44,536	14,821
All classes	396,867	1,381,889	149,849	308,764
	All hardwoods		All softwoods	
6 & 8	345,018	934,450	133,503	238,537
10 & 12	433,079	1,058,099	133,357	472,165
14, 16, & 18	415,668	803,188	94,927	246,064
20 & over	271,663	303,038	54,953	30,666
All classes	1,465,428	3,098,775	416,740	987,432